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THE MEANING OF TREE-LIFE.

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Few there are, even among thoughtful botanists, who seem to clearly realize how broad a lesson on the life-history of plants is written in the trees that make the great forest regions of the world. Whether we stand among the palms of the tropics, or the pines of the north, or the congeners of the poplar and oak, we feel instinctively that there is an impressive depth of meaning in the very aspect of a tree. And it is no deception of the fancy. Tree-life represents the culmination in the work of one of the two great factors, reproductive energy and vegetative energy, that together shape the course of plant-development. The history of plants records a constant two-fold struggle; on the one hand the effort of plant-life as a whole to perpetuate itself by improving its methods of reproduction; on the other, the stand for self-preservation made by each distinct individual or species or group,—a stand that can be taken only through sheer force of vegetative luxuriance. But these two phases of the struggle for existence have by no means been independent of each other; they have acted together in varying ratio in the making of every type, though their respective influences have culminated in widely separated forms. As the highest outcome of evolutionary progress in the character of floral organs we point to

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the orchids, among Monocotyls, and the kinsmen of the golden-rods and asters, among Dicotyls; as the monarchs of vegetative energy stand the tree-ferns and towering palms of the tropics, the Red-Woods of California, the Eucalyptus of Australia, and our forests of mighty oak. Thus the classification systems of modern botany that review in the clearest scientific light the evolutionary relationships of species, genera, orders, and classes, present to us only one side of the problem of plant-life; the dynamics of vegetation is the other. We may know that the Coniferae are among the most primitive of flowering plants, and the Orchidaceæ and Compositæ among the highest; but why do we find our orchids and composites growing as stunted herbs in the very shadow of conifers that are giant trees? Which is master of the situation? Systematic botany has not fulfilled its mission until it has grasped both sides of the two-fold relation that the contrasting types bear to one another.

Far back in geologic time the dawn of tree-life came almost with the beginnings of vegetation. What the earliest of those beginnings were we can scarcely even conjecture, but going back as far as fossil botany will carry us with certainty, we may conceive something of the conditions under which the primitive plant-world was fostered. Consider the probable conditions of the Cambrian and Silurian Ages. However, scant the records that we hold, they are yet sufficient to give us some suggestions of inestimable importance. Past question the earliest forms of plant-life were denizens of the water, developed in the seas and lakes of Pre-Cambrian times. From their aquatic habitats they must have first gradually emerged, as the cooling of the primordial continents permitted, and the strengthening of their own anatomical characters favored, into the swamps and marshes, and then step by step mounted the higher regions of the dry land. The oldest fossil types we with certainty know of were far from the beginning of the scale; they could only have been products of ages of development that must forever remain to us almost a total blank. The world of Silurian times was probably a torrid zone from pole to pole, a condition traceable in large part to the insular

character of its continents. The surcharging of the atmosphere with water-vapor meant excessive precipitation, and the shallow-water conditions obtaining around the continental islands, together with the probable lowness of these isolated landmasses favored the existence of extensive swamps and marshy flats, in which the water may have been either fresh or brackish. Here in these primordial swamps the vegetation destined to cover the earth made its determined struggle for existence. On the higher land there was too much heat; in the seas there was too much water; in the swamps was the requisite combination of water, heat, and heavy carbon-laden air. Under such conditions the first types that took possession must have spread and multiplied with incredible rapidity. What followed? Inevitably the primitive low-growing plants crowded closer and closer together and became a rank tangle of growth; where there had been at first plenty of room for every individual to spread, there were now many struggling for the mastery of each square foot of swamp. All had a foothold in the earth but only the few that stood the highest could drink in the feeble rays of the cloud-bedimmed Silurian sunshine. Then the real battle for the light began in earnest, the stronger against the weaker, the older established types against the newer ones whose foot-hold was less certain; higher and higher the rank swamp-growth rose, all its members struggling together for the light and open air. And so in the wierd gigantic club-mosses of those far-off times we see the prophetic beginnings of the tree-life of to-day; and to trace the development of the majestic forests of the present from those dank swampy jungles of the past is the problem before us. It would seem at first glance that in the primæval jungle "might made right," if ever it made it anywhere. But no! the "survival of the fittest" worked in two directions. Vegetative luxuriance was a tremendous factor in determining the survival of types, vastly more so then than now; but wherever an improvement in the character of reproductive organs increased the certainty with which any plant could perpetuate its race, that gain could often far outweigh the superior vegetative luxuriance of all competitors. This second factor in the "survival of the fittest"

has been steadily waxing in importance from primæval times, while the other has begun to wane. In the midst of the Silurian jungle, where the energy of plant-life was strained to the utmost limit of activity, new forms originated. What was their fate? They could not overpower the strongly established older forms crowding all about them, so either they must perish or push outward toward the open margin, where there was room to fight. Thus the swamp-margin became the tension-line between the uninhabitable higher land and the old strong hold of the jungle, and on this tension-line stood the vanguard of the world's future vegetation. On its outer edge the tension-flora faced a new and untried habitat, and then, as now, a highly specialized habitat meant highly specialized inhabitants. The untried ground could not be conquered by sheer force of vegetative luxuriance, for by their very nature the new conditions were physically opposed to the established order of things in plant-life. The all-powerful factor in accomplishing the conquest was increased capacity for variation and the adaptive evolution of old structural types into higher stages of organization. Clearly, this tendency predominated and pervaded the whole tension-line flora, but its maximum was toward the outer edge. So here were ranked the low-growing herbaceous forerunners of coming ages,—forms that were humble in their growth, because of the physical obstacles opposing them; and highly specialized, because their structure did not possess the obstinate stability of the patriarchal tree-life behind them. For the same reasons the character of the undergrowth in the jungle must have always been ages in advance of the arboreal monarchs towering overhead. But on the inner side of the tension-line, vegetative luxuriance was not only possible and potent but also obviously a necessity, for there could be no abrupt demarkation between the marginal and central regions. Here, then, where the jungle-flora merged into the tension-flora, was the stronghold of the rising generations, the newer higher types, of tree-life. Here, in early Silurian times, must have stood the ancestral types of the great tree-ferns and calamites and conifers that were to be supreme in the Carboniferous and early Mesozoic.

The history of plant-life through the later Silurian and the Devonian Age records the first strong establishment of a truly dry-land flora, a substantial foreshadowing of the Mesozoic. The changes in physical conditions of course furthered this result no less truly than did the adaptive evolution of organic forms. In the dry-land forests of the Devonian rose the vegetation whose future developments should hold dominion when the primordial swamps had disappeared from the earth. But these terrestrial forests evidently had the effect of removing an immense part of the pressure upon the old swamp-jungles by becoming the main refuge and stronghold of the new types crowded out at the old tension-line. This, together with the physical changes recorded in the rock-systems of the times, gave full vent to the gathering vegetative energy that reached such a stupendous culmination in the mammoth swamp-flora of the Coal Age. Here was a turning point in plant-history. With the dawn of the Mesozoic came the clear prophecy of modern conditions. The dry-land forests of the Reptilian Age were the full realization of the conditions foreshadowed in the Devonian. Out of the swamp-forests of the Carboniferous came some of the highest Lycopods, great Tree-Ferns, and giant Equisetums. Down from the Devonian came the Conifers of the yew-family; and as reminders of the old genus Cordaites the new order Cycadaceæ appeared. Undoubtedly it is impossible to believe that the swamp-flora of the coal seams represents anything like the whole flora of the Carboniferous Age. There must of necessity have also existed then a great transitional dry-land flora between the terrestrial forests of the preceeding Devonian and the succeeding Jura-Trias. Much of the strata called Devonian or Mesozoic probably represents this transition and was synchronous in its formation with the accumulation of the coal. Part of the transition is clearly observable in the noncarboniferous formations included between the coal-seams. While the preparations, begun in the Devonian, for the great Mesozoic forests were slowly and surely progressing, the old vegetation of the swamp-jungle swept up to its culmination, and marked by its decline the close of the Paleozoic Era. The early Mesozoic

became the age of Gymnosperms. Vegetation had come upon a new battle-field, the terrestrial forest-ground, and only the most highly organized types of preceeding ages were fitted to enter the struggle. Many of the Tree-Ferns and Equisetums were still powerful, but the supreme dominion passed over to the Conifers and their allies, the Cycads. The great forests of Conifers had their undergrowth and their tension-lines, and here the development of new types was progressing with probably even greater activity than in the tension-floras of earlier times. The greater complexity of the conditions confronting a terrestrial flora over those confronting a swamp flora would necessarily mean more elaborate specialization. While the ancient coniferous tree-forms were mounting to the fulness of their power the first types of the higher flowering-plants were beginning to appear; and with the opening of the later Mesozoic, the Cretaceous, two new groups of tree-life came upon the stage as worthy competitors of the old established Gymnosperms. One was the order Palmaceæ, representing the Monocotyledonous Angiosperms; the other was the amentaceous hardwood tree-families, representing the Dicotyledons. The opening chapter in the history of these two groups is a matter of peculiar interest.

It is probable that the two groups were almost, if not quite, synchronous in their rise; though there is some reason to believe that the Palmaceæ, or at least their forerunners, the Pandanaceæ, are slightly the older. As has been indicated the central strength of the Mesozoic forests was undoubtedly held by the coniferous trees; and probably by far the greatest strength was vested in the near allies of the Cypresses, Pines, and Firs,—representing the tribes Cupressineæ, Taxodieae, Abietineæ, and possibly also Araucarieæ,—while the older suborder Taxineæ, the broad-leaved Conifers of the Yew family, were rather crowded out toward the tension-line margins along with the Cycads and Tree-Ferns. Among these last the first low-growing Tree-Palms probably rose, as the products of a long course of elaborate specialization. It is more than possible that the Pandanaceæ represent at least in part a transitional stage between some of the higher Gymnosperms and the

Palmaceæ; and it is well worthy of note that the aerial roots of the Screw-Pines, the Pandanaceæ, are a living memorial to the position they originally held on the shore-margin of a forest tension-line. The habit of growth of the Palmaceæ most strikingly suggests that their first competitors were Tree-Ferns and Cycads, even as they are in many regions to-day. It seems as if the first Palms had met the Mesozoic Tree-Ferns and Cycads on their own ground,—the forest margin,—with their own weapons—the tall aspiring trunk topped with a crown of leaves. And by their general higher character of organization the Palms ultimately asserted their preeminent superiority. The wide constrast between the floral characters of the Palmaceæ and those of the Gymnosperms presents a difficult problem. There is a strong likelihood, however, that the spadiceous inflorescence of the Screw-Pines and Palms is a highly specialized development from the cones of some aberrant Cycad or Conifer. At least all the probablities indicate that the spadiceous Monocotyls approach much nearer the Gymnosperms than do any of the non-spadiceous ones. All this has evidently a most significant bearing on the question before us, of the Palms' place in Nature. We have seen that the vegetative character of the Palms was widely different from that of the dominant Conifers; and now we note that their floral organs were also widely different, and in fact far more decidedly unlike the cones of the Cypresses and Pines than are the "catkins" of the hardwood dicotyl trees.

There are a half-dozen or more tree-orders among the Dicotyls that should really stand apart as forming a small subclass quite decidedly distinct from the rest of the Dicotyls. As the principal orders of this group may be named the Juglandaceæ, Myricaceæ, Salicaceæ, Betulaceæ, Fagaceæ, Ulmaceæ, Platanaceæ, and a couple of others. These have been called the Amentaceæ, or the Diclinæ, and might be regarded as a subclass. Except in the approach of Ulmaceæ to the Urticaceæ, the Diclinæ stand clearly apart as a distinctive highly specialized alliance of trees and shrubs. Their relation to the Mesozoic Gymnosperms is an interesting question. In general habit of growth and in the character of their wood they evidently make a close approach to the Coniferæ.

The amentaceous inflorescence predominating in the group bears a decided likeness to the cones of the Pines and Cypresses. Obviously then, the Diclinæ were the trees best fitted to battle with the central stronghold of the Mesozoic coniferous forest, and probably they were first fully developed on the inner portion of the tension-line, face to face with the strongest of the Conifers. Behind them, toward the outer edge stood the Tree-Ferns, Cycads, and Palms; but which, we may ask, were the Conifers that stood closest round about, among and before them? Probably the sub-order Taxineæ, the fraternity of broad-leaved Taxites and Gingkos. The power of this most ancient group of Conifers had, as we have seen, waned, and they must have been driven toward the outskirts of the forest by the stronger Cupressineæ and Abietineæ. Here they must have met the early Diclinæ. Where did the Diclinæ develop the broad flattened leaf-blades that so strikingly distintinguish their foliage from that of our living Coniferæ? Where, if not in a competitive struggle with the broad-leaved Taxineæ of the Mesozoic forest-margin? The ancient Taxineæ had reproduced in their foliage something of the character of the fern-fronds; the newer Pinaceæ had rather imitated and exaggerated the scale-leaves of the great Carboniferous Lycopods. And finally, the broad leaves of the Taxineæ were perpetuated, under greatly improved and elaborated forms, in the Diclinæ. Through the Cretaceous the Coniferæ rose to the zenith of their power; the Tree-Ferns and Cycads weakened; the Palmaceæ and Diclinæ, more particularly the latter, fast gathered strength toward the dominion they claimed in the succeeding Tertiary. Meantime, in the undergrowth and on the open margins of the forests, and on the open country that did not support a growth of trees, the evolution of the higher types of Monocotyls and Dicotyls was rapidly progressing. Many of the stronger forms became shrubs, and here and there a peculiarly favored type rose from lowly herbaceous to arborescent habit, and thus founded a new tree-group. Such, for instance, were the Magnolias and Tulip-Trees and Maples and many others. In all this we read an increasing complexity in the conditions presented to onward struggling plant-life, and here a vitally important point rises for our consideration.

(*To be continued.*)

THE SCOPE OF MODERN PHYSIOLOGY.

By Frederic S. Lee.

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Three achievements of the present period have shown investigators how broad their science really is. First, the establishing of protoplasm as the physical basis of life, and of its substantial identity in plants and animals by Dujardin, Von Mohl, and Max Schultze, showed that the really fundamental problems of life and action had heretofore not been grasped; that the essential laws of protoplasmic activity apply to the whole organic world; and hence that any physiology which confines itself rigidly to either plants or animals to the exclusion of the other is a one-sided science. Second, the cell-theory of Schleiden and Schwann demonstrated that sooner or later many functions must be traced back to the cell, and that a cellular physiology is the key to a large proportion of the problems arising in the biological world. Third, the work of Darwin, based, as it was, upon physiological principles, showed that the action of the environment upon the individual and upon the species, as well as the action of the organism upon the environment, was an almost unworked field of the richest promise; that all physiology, in order to be complete, must be comparative; that there is an ontogenetic and a phylogenetic evolution of function; and that the physiological laws of heredity were yet to be discovered.

Let us examine these ideas briefly. The necessity of understanding the physiology of undifferentiated protoplasm is obvious, for there we find function in its simplest and most generic form. The phenomena of projection and retraction of pseudopodia in the Amoeba are doubtless the key to the complex processes of contraction and relaxation of striped muscular tissue. It is not at all improbable that the action of light upon the retina is a specialized derivative of the heliotropic phenomena of the simplest plants and animals. Four years

ago, the well-known Oxford physiologist, Burdon Sanderson, wrote concerning the nature of the physiological inquiry, "The work of investigating the special functions, which, during the last two decades, has yielded such splendid results, is still proceeding, and every year new ground is being broken and new and fruitful lines of experimental inquiry are being opened up; but the further the physiologist advances in this work of analysis and differentiation, the more frequently does he find his attention arrested by deeper questions relating to the essential endowments of living matter, of which even the most highly differentiated functions of the animal or the plant organism are the outcome." Again, "No one who is awake to tendencies of thought and work in physiology, can fail to have observed that the best minds are directed with more concentration than ever before to those questions which relate to the elementary endowments of living matter, and that if they are still held in the background, it is rather because of the extreme difficulty of approaching them than from any want of appreciation of their importance. * * * * If we really understood them, they would furnish a key, not only to the phenomena of nutrition and growth, but even to those of reproduction and development. * * * * It is in the direction of elementary physiology, which means nothing more than the study of the endowments of living material, that the advance of the next twenty years will be made."

Regarding the need of a cellular physiology, it is only necessary to review our knowledge of any one of the complicated organs to perceive that aside from the principles, often chiefly mechanical, involved in the work of the organ as a whole, the essence of its activity lies in the activity of its component cells. The work of the muscle, *e. g.*, is the sum of the activities of its constituent physiologically similar fibres. A single gland cell illustrates the principles of secretion as well as, or even better than, a thousand grouped together into a compact gland. The complexity of brain operations is due to the complexity of brain structure, but the active agents are the comparatively simple nerve-cells. Huxley sets forth as the first three of the five chief ends of modern physiology: "Firstly, the ascertain-

ment of the facts and conditions of cell-life in general. Secondly, in composite organisms, the analysis of the functions of organs into those of the cells of which they are composed. Thirdly, the explication of the processes by which this local cell-life is directly, or indirectly, controlled and brought into relation with the life of the rest of the cells which compose the organism." Now that the structure of protoplasm is fast becoming disentangled, a rational cell-physiology will be possible. In urging the need of investigating cell-function, I do not mean to imply that the cell is necessarily the ultimate unit, and that the organism is to be regarded as substantially a colony of physiologically independent cells. Much of the recent cytological work indicates that ere long the cell may be deposed from its hierarchical position.[1] Cellular interactions are to form an increasingly prominent place in the researches of cell-physiologists. But, whether or not we grant with many that the cell is of secondary significance, we must allow that, in many respects at least, it may be regarded as a physiological unit; and from this standpoint it demands investigation.

In these days of comparative science, it seems superfluous to urge the necessity of a comparative physiology. No one, who thinks seriously of the matter, will doubt that along with the morphological distinctions between different species, genera, orders, or classes, and even in cases where gross morphological distinctions are not apparent, there must be physiological differences. Beyond the obvious facts of simple observation, these are almost wholly uninvestigated. De Varigny, in his suggestive little book on Experimental Evolution, has collected a number of the known facts. In a garden in the south of France, were growing, side by side, a number of plants of the same species. There appeared to be no morphological differences between them, but some were indigenous to the soil in which they were growing, while others had been imported from the Canary Islands. When they were attacked by frost, all the Canary Island forms perished, while the French forms were untouched. There was evidently some obscure physiological difference between them. The two common European species

[1] Cf. Whitman, *Journal of Morphology*, VIII, No 3, August, 1893.

of frogs, *Rana temporaria* and *Rana esculenta*, behave very differently toward certain drugs, as Schmiedeberg, Monnier, Vulpian, Harnack and Meyer, and others have shown. In *R. temporaria*, caffeine causes a decrease in excitability; in *R. esculenta* an increase; in *R. temporaria* pilocarpine causes paralysis; in *R. esculenta* tetanus. The venom of one snake is harmless for its own species, but poisonous for others. The spinal cord of the fish is differently endowed from that of the frog, though the differences have never been properly investigated. The muscle of the Insect is far removed functionally from that of the Crustacean, though how far remains to be discovered. I do not overlook the fact that already much excellent work upon the physiology of the Invertebrates and lower Vertebrates has been done, but too often such work has not been *comparative*. Fitness for the object of the research is the usual determinant of choice—and hence the frog has taught us most of our physiology of muscle. Sooner or later this must all be changed, the functional differences must be made known, and the exact position of each plant, each Invertebrate, and each Vertebrate, in the physiological series, together with the exact position of his organs and tissues and cells must be understood. For we must recognize the fact that function in any one species has *come to be*—an evolution of function is as much a reality as an evolution of form. The adult body and its organs, tissues and cells are the functional derivatives of the germ-cells—in the growth of the individual there has been a physiological ontogeny. So in the growth of the species there has been a progressive or retrogressive development of function; and one of the most attractive fields for our future work will be the tracing out of the phylogeny of function, now a practically unknown subject.[2] The difficulty of such an undertaking is great, for the rich palaeontological series is beyond the reach of the experimentalist. Yet this should be no bar to the systematic investigation of existing forms. Such a phylogeny will vary with each functional part (organ, tissue or cell); *e. g.*, if, in one genus, certain brain functions and certain secretory functions are always found, the presence of the same brain

[2] Cf. Dohrn, *Das Princip des Functionswechsel.*

functions in another genus does not necessarily indicate the presence of the same secretory functions. Nor will the line of functional descent of a part necessarily coincide with the line of morphological descent of the organism. A natural system of classification is based and, justly so, on morphological considerations. In thus tracing out the genetic relationships of function, lie the attractiveness and the utility of the comparative method in physiology. And I venture to assert that, if all investigators would bear in mind the fact of an evolution of function, surprising advances would result in our knowledge of the working of adult organs.

What is it that makes an individual physiologically what he is? There are two agents—heredity and the environment. As to heredity, the active discussion now going on around Weismann as a centre, serves to show what a vast amount we do not know, on both the morphological and the physiological sides as regards the general phenomena of heredity and the nature and behaviour of the hereditary substance. No one recognizes this more fully than Weismann himself. He confesses that his own theory is far from complete; that its importance consists primarily in its suggestiveness; that the real solution of the problem lies in the future, and that facts are greatly needed. In this connection I may refer to the value of the work of Nussbaum, Gruber, Balbiani, Hofer, Korschelt, Verworn and others on the physiological relations of the nucleus and cytoplasm.

The mutual relations of the environment and the individual are almost as unknown as when Darwin first demonstrated their importance. In a few special lines they have been investigated. In his earthworm studies Darwin himself set an eminent example. The fact of the modification of the virulence of pathogenic bacteria by their treatment during growth is well known. Interesting results have been obtained regarding the action of salt-water on fresh-water animals, and *vice versa;* the action of salts on starch production in plants; the effect of depriving animals of apparently important salts, *e. g.*, fowls of carbonate of lime, and crabs of calcium chloride. Maupas's well-known studies on the influence of temperature on

the determination of sex may be mentioned here, as well as those of Yung, Mrs. Treat, and others on the influence of foods. If an altered environment is capable of altering function—and we know this to be a fact—and if the altered function reacts upon structure—which is equally undoubted—then we find in these premises sufficient justification for searching after the facts concerning the nature and extent of environmental influence. The value of such researches lies not so much in the isolated results themselves, as in the fact that such results, when sufficiently numerous, will lead us directly not only to a better understanding of the internal physiology of organisms, but, what is of more general interest, to an understanding of the causes of variation, and thus to a better comprehension of the relations of species to one another. Too much cannot be said upon this phase of our subject. Whether the direct action of the environment is to be considered as a factor in organic evolution or not, the causes of variation must be investigated *experimentally*, and the physiological side of the work must not be neglected. Semper says, "Although the morphological section of animal biology[3] teaches with much probability that this species or that organ has undergone this or that course of modification in the animal series, and that in the process of modification it has passed through a whole series of various forms, still it is only physiological research that can elucidate the necessity for their existence by revealing their causative conditions."

One word regarding the relations of physiology and morphology. In the broad way in which I have outlined the former science, it may be charged that I have trespassed upon the morphological preserve. I do not deny the charge. It seems to me altogether unnecessary, undesirable and moreover impossible to draw a sharp line of distinction between the two sciences. With a common origin, mutual independence was, in time, necessary to the growth of each, yet this is in entire harmony with the fact that they have a common meeting-ground. In these days, as always, the morphologist must be something of a physiologist; the physiologist something of a

[3]He might justly have omitted the word "animal."

morphologist. The current researches and discussions on evolution, heredity, and other fundamental questions make this constantly more evident. Like zoology and botany, each has its special field of labor, its special methods, and its special problems; but the fields are constantly overlapping, the one learns methods from the other, and the ultimate problems of both are the same.

Let us now draw together the main lines of our thesis. I prefer to conceive of physiology as the science of the dynamics of living matter. Its tasks for the future seem to comprise the following classes of investigations.

First, the functions of adult organs, tissues and cells in plants, Invertebrates and Vertebrates. The greatest interest at present appears to center about the phenomena of heredity, the central nervous system, and general cell physiology. Second, the ontogeny of functions, or embryological physiology. Third, the phylogeny of functions. Fourth, the physiology of organisms, comprising the mutual relations of organisms to each other and to their environment.

It would be superfluous here to discriminate between the opportunities for research offered in these four classes of problems. Each covers a wide field of rich promise. Each is largely worked—in reality, as we have shown, research in the past has been confined almost wholly to the first group. Each will lead the investigator to fundamental problems.

In considering these tasks it will be perceived that I have viewed the organism in two aspects, in its internal and its external relations. The problems of the first three groups may be regarded as belonging to *internal physiology*, those of the fourth to *external physiology*. Nearly twenty-five years ago, Haeckel made a similar division into *Conservations-* and *Relations-Physiologie*.[4] Such a classification is convenient and valuable. But it must be remembered that it is artificial, and must not be taken as indicating a fundamental distinction between two sciences. The two are departments of the one science, physiology, and pass the one into the other. For a fact that becomes the more striking, the longer one studies the

[4] *Jenaische Zeitschrift*, V, 1870.

dynamics of living matter, is the utter impossibility of drawing a sharp line between the internal and the external. The functional organism is constantly acted upon by the environment, and is incapable of existence apart from it. But the functional organism is but the *ensemble* of the functional parts, and the parts are linked functionally together, constantly acting and reacting upon each other and modifying each other's work. It follows that the innermost portions cannot free themselves from environmental influence, and the attempt at an essential separation of internal from external physiology is in vain. Nor is such an attempt justified any the more by methods of investigation. For he who studies the action of light upon the retina, is thereby fitted to investigate the heliotropic phenomena of the organism; and he who is familiar with methods by which the effect of salts or temperature on the organs is tested, is most capable of testing the influence of the composition and the temperature of the surrounding water upon aquatic animals and plants. I speak of this the more especially because of the fact that, since the completion of the greater portion of this paper, the able address of Professor Burdon Sanderson, as President of the British Association for the Advancement of Science, has appeared.[5] In an interesting manner Professor Sanderson reviews the aspects of physiology since the time of Müller. He says, "The distinction * * * * between the internal and external relations of plants and animals has, of course, always existed, but has only lately come into such prominence that it divides biologists more or less completely into two camps—on the one hand, those who make it their aim to investigate the actions of the organism and its parts by the accepted methods of physics and chemistry, carrying this investigation as far as the conditions under which each process manifests itself will permit; on the other, those who interest themselves rather in considering the place which each organism occupies, and the part which it plays in the economy of nature. It is apparent that the two lines of inquiry, although they equally relate to what the organism *does*, rather than to what it *is*, and therefore both have

[5] *Nature*, September 14, 1893.

equal right to be included in the one great science of life, or biology, yet lead in directions which are scarcely even parallel." Giving then a somewhat misleading interpretation of Haeckel's ideas above referred to, Professor Sanderson proceeds to divide Biology into three parts, Morphology, Physiology, which deals with the "internal relations of the organism," and Oecology (a term borrowed from Haeckel) "which concerns itself with the external relations of plants and animals to each other, and to the past and present conditions of their existence." In another place, Professor Sanderson says, "No seriously-minded person, however, doubts that organized nature, as it now presents itself to us, has become what it is by a process of gradual perfecting or advancement, brought about by the elimination of those organisms, which failed to obey the fundamental principle of adaptation, which Treviranus indicated. Each step, therefore, in this evolution, is a reaction to external influences, the motive of which is essentially the same as that by which, from moment to moment, the organism governs itself."

I realize how presumptous it appears in me to differ from or attempt to criticise the views of one who occupies so deserved a place among the foremost physiologists of to-day. Yet I cannot repress the thought that the author of the Nottingham address viewed his subject more in the waning light of a day that is ending than in the brightening beams of a coming dawn. If each "step * * * * in this evolution is a reaction to external influences," why should not the student of the "steps" study also the origin and causation of those steps? I think he would justly be open to the charge of narrowness if he did not do it. And, moreover, as I have indicated above, I believe not only that he of all is best fitted, but that a rational view of his science forces him to do it. The progress of a scientific physiology has been greatly retarded by its followers confining themselves too exclusively to "the internal relations of the organism." Not the least of the retarding consequences is the fact that thereby the science loses much of its attractiveness. Just as anatomy, illumined and vivified by the theory of evolution, and broadened by the incorporation of embryol-

ogy and paleontology, became the science of morphology, so I believe that physiology is destined to undergo, and is undergoing, a similar vivifying and broadening process, and is to become the science of vital phenomena, wherever and however they may be exhibited.

UNUSUAL FLIGHTS OF THE GROUSE LOCUST (TETTIGIDEA LATERALIS SAY,) IN NORTH EASTERN ILLINOIS.

By Joseph L. Hancock.

At certain times, seemingly without premonitory indications, some insects suddenly change their habitat; although closely allied forms inhabiting the same locality under similar general influences, show no disposition to do so. That there are predisposing conditions which are the ruling causes of these specific migrations is plainly evinced by careful study. Before confining our remarks to a single species *Tettigidea lateralis* Say, "The Grouse Locust" as an illustration in point, a sketchy recapitulation of the phenomena of migration in the family Acrididæ, of which the above is a member, may be given to some advantage. The various forms of grasshoppers, constituting this large family, are not as a rule migratory; as a matter of fact, somewhere near a dozen only are given to making sudden sweeping changes, by flight over a large territory foreign to their hatching grounds. In two species, whose anatomical differences are but very slight, one may be truly migratory while the other is not, as seen for example, in *Melanoplus spretus* and *Melanoplus femurrubrum*. The confusion arising from an indefinite interpretation of migration in its truest sense, as distinguished from the shorter "local flights" as appled to insects, is often perplexing. Let us attempt to set at rest, as far as possible, such misconception of terms.

Individuals of a species which effect a more or less regular periodical change in their habitat, are truly migratory. Migrations may be primary, consisting of local flights; such as movements by insects hatched in temporary regions to which they confine themselves to passing to and fro, from point to point, or secondary, as the repeated periodical changes of residence covering foreign fields, which virtually establishes a nomadic habit. We have hinted that there are predetermining

conditions effecting these movements, principal among them being a break in the interrelation of food supply, or improper conditions for the carrying on of propagation. The unusual appearance of insects in a given locality, classed under the category of primary or "local flights," are met with occasionally by observers. One of considerable moment is set forth in the following narration: On the nineteenth of September, 1893, the Grouse Locust, with a few other members of Acrididæ, striking out for more favorable conditions, landed at night in swarms in Chicago. The writer noticed them everywhere in the city. The small size of this locust (♀, ♂—12–16 mm.) in length, with peculiar inconspicuous colors, caused them to be overlooked by the people passing the next day who, without being conscious of the fact, crushed thousands under their feet, leaving tiny stains upon the sidewalks. Again, two days following their first appearance, on the twenty-first inst., multitudes of Grouse Locusts dropped during the night. As individuals, they were comparatively large and vigorous. Many were taken to indicate the range of flights; specimens being recorded at scattered points. A region covering, not only the City of Chicago, but the northeastern portion of Illinois and that part of Indiana including the lower bend of Lake Michigan adjacent, as shown in the accompanying map Fig. 4, was represented. Observations in the city showed that the electric arc lights, to which they were attracted, killed off large numbers, while the stretch of waters in the lake destroyed others.

Through the streets, in the heart of the city, the writer collected in a short time, twenty-seven specimens, comprising thirteen males and fourteen females, showing a remarkably even distribution of sexes. A significant point indicating the direction from which they came was gathered from the fact that most, if not all the specimens, when examined, on the streets running east and west, were on the north side of the street, showing that they were blown against the tall buildings and then dropped to the ground. Information received from Mr. H. C. Frankenfield, local forecast official, who kindly favored the writer with a report, giving the direction of the wind

at the time of the flights, is appended below. It is interesting to note that the preconceived idea of their course was confirmed. His report indicated that the wind during the twenty four hours which brought in the Grouse Locusts on the night of the nineteenth inst. blew from :

Southeast	2 Hours.
South	3 Hours.
Southwest	19 Hours.
Total	24 Hours.

The general direction pointing from the southwest. In the second flight the wind blew from :

East	1 Hour.
Southeast	18 Hours.
South	4 Hours.
Southwest	1 Hour.
Total	24 Hours.

Showing a mainly southeastern wind.

Nothwithstanding a residence of many years in this locality, no other instance of unusual migration of this particular species has been observed, except during the preceding fall, 1893, which was characterized also by flights in very small numbers, marking the first instance of their occurrence here. Of the natural breeding grounds of this species, but little is known in this section of the State of Illinois, beyond the fact of their existence along the Des Plains River at Riverside. In general terms, it may be inferred that the natural habitat is along the border of streams (J. H. Comstock[1]), about ponds (W. S. Blatchley[2]), in the vicinity of mud flats and low marshy places. The species is sub-aquatic in habit and widely distributed. (Lawrence Bruner[3]).

The predetermining causes of the singular flights noted above, may have been induced one way or another by the extreme dryness of the fall seasons of 1892–3. Indeed it is safe to assume that these conditions played a direct part, as will be

[1]Introduction to Entomology.

[2]From specimens so labeled in my collection.

[3]MS. letter.

seen from the following observations. On September 16, 1893, it was observed that the large stream at Riverside, a few miles west of Chicago, was so low that in many places one could travel across on the limestone bed, a thing before impossible. Along the banks of this stream Orthoptera appeared uneasy and much affected by the heat prevailing at the time. To the southeast and southwest, the directions from which the Grouse Locusts were blown, for miles the broad stretch of marshes, sloughs, small streams, ponds and lakes were dried, changing decidedly the topography of the districts. The effect upon animal life was to cause the shifting about of many kinds. The young grasshoppers, unusually favored, passed on to maturity aided by a scarcity of birds, their natural enemy, moreover, circumstances on every side being favorable, allowed excessive numbers to develop. Multitudes infested the regions where usually a few existed. By late fall the soil was baked by the heat, giving rise to a difficulty in finding a suitable place to deposit their eggs. Later, still further changes were enacted, for those habits ordinarily sedentary, now took on a tendency to be nomadic. Simultaneously, a kind of restless irritation took possession of the insect. Rising in the air in short flights to rid themselves of distress, aimlessly they pursued these movements through the day seeking for shelter. Ere long, a wind rushing in to take the place of the rarefied air, moving upward, bears off to distant points those caught up in its irresistible powers. Upper air currents may blow from three to twenty miles an hour, so basing an estimate on these grounds, a day's flight may be approximated at from twenty to one hundred miles. When subjected to a test the Grouse Locust's flight, ordinarily, is quite prolonged, being swift and noiseless. Referring again to the map Fig. 4, (shaded portion) an idea may be gained of the local flights of this little locust. If the furthest point be placed at one hundred miles distant from Chicago, the local point of observation, taking into consideration also the specimens found, the section of northeastern Illinois including the Kankakee River and its branches, the outlying marshy districts, various streams, ponds and tributaries of the Illinois River and the section

swept as shown on the shaded portion of the map in the north western corner of Indiana, contributed specimens to the flights. While more or less speculative, this paper is a step toward establishing a knowledge of the migrations in the Grouse Locust, of which little has been said by previous writers.

Explanation of Plate, No. XIII.

Fig. 1, 2 and 3, Tettigidea lateralis Say, all natural size; from nature.

Fig. 1. Female with wings extended.

Fig. 2. Seen from above.

Fig. 3. Side view.

Fig. 4. Map showing flights of T. lateralis in 1893. Clouded area indicating supposed habitat and section covered by the flights.

[c]. Chicago, local point of observation.

Chicago, Feb., 1894.

A GLACIAL ICE DAM AND A LIMIT TO THE ICE SHEET IN CENTRAL OHIO.

By W. G. Tight.

The great continental glacier of the Plistocene will ever present many interesting problems to the student of those times. Its effects may be grouped under two heads; first, the general and widespread results of glacial action, and second, the local and minor effects produced by the action of local forces.

Believing that a careful study of these limited phenomena will help to illustrate some of the larger problems and enable us to gain a better understanding of the geological history of Plistocene times, the liberty is taken to present a few points of surface geology of a very limited region. It is hoped, however, that the accompanying map and sections will prove of interest.

Licking County lies near the center of Ohio, and is drained by the Licking River, which is formed at Newark by the confluence of three streams, The North and South Forks and Raccoon Creek. These streams form a hydrographic basin which is very nearly co-extensive with the county lines. The Raccoon Creek and North Fork rise in the western and northern portions, which are rather high lands; they flow through broad and open valleys, ranging from one-half to one mile in width, between the Waverly hills.

The valleys are filled with drift to a depth of 100 to 150 feet, increasing in depth toward their lower portions until at Newark the gas well borings show a valley filling of over 300 feet. These two streams are of rapid fall, ascending 250 to 350 feet in the 40 to 50 miles of their lengths.

The South Fork rises on high ground in the south-western portion of the county, flows south and east to near the Licking Reservoir, which lies about 125 feet above Newark, from this point the watercourse is almost due north to Newark.

Along the east side of the North Fork, the hills rise rapidly to an elevation of about 250 to 300 feet, as they also do along the east side of the South Fork. Standing on these hills and looking west the country appears to gradually rise, but no very high hills are visible in this direction. A level, however, reveals the fact that the land to the west is nearly as high, but is so filled in with drift that only the tops of the hills appear above the general level.

In a few words, then, the conditions are these: waters flowing from the north, west and south, meet at near the center of the county and start due east, flowing a few miles over a broad flood plain, and then plunging directly into the hills of the eastern portion of the county and finally reach the Muskingum at Zanesville.

As the Licking River leaves the open plain it enters the hill country in a narrow gorge with perpendicular walls 50 to 100 feet high, and the hilltops, only a few hundred feet back on either side, rise 300 feet higher. This gorge is commonly known as the Licking Narrows, and is the subject of this sketch.

For about the first mile of this narrow cut there are two or three large curves, but the gorge is on an average about 500 feet wide, and confines the river in narrow limits. The Baltimore and Ohio Railroad makes many rock cuts in order to get along on the south side, and there is scarcely room for the towpath of the canal on the north side. The canal is in the river through this gorge.

The left-hand margin of the map, plate XIV, represents the river at the center of the last curve of this mile of gorge. The walls at X are 45 feet high and overhanging, showing a large amount of undercutting on the curve. The heavy shaded line represents the outcrop of the Waverly or Logan Conglomerate, and wherever exposed presents an escarpment with an elevation represented by the figures on the contour lines.[1]

The last curve of the gorge referred to above, extends to about O and P, at which point the curve of the next sigmoid

[1] All vertical measurements are from the water level in the river, which is constant on account of the dam below.

begins. The gorge runs on past L m to the center of the next curve at OO, completing the curve at the point n.

The river, however, does not follow this course, as will be seen by following the shaded portion which represents the present river course, but turns at a right angle and runs through a rock cut 150 feet wide, with overhanging walls at both g and c′.

Just south of c′ the railroad has made a rock cut 45 feet deep on a very sharp curve in order to get through the gorge. The rock g, known as Black Hand Rock, stands out with a bold front 45 feet high and 250 feet long next to the river, where the tow-path of the canal had to be blasted out. The rock slopes on its top toward the north, and presents an overhanging wall about 20 feet high on that side.

Within the large open area of the unoccupied curve north of g there is a low mass of rocks presenting the form indicated at m, with a vertical rock exposure 10 feet high on the south side of the mass and gradually falling off into the lower channel OO, which is only 4 to 5 feet above water level. At n, and between g and m, are ponds of water on a level with the water of the river. The channel, between g and m, is about 70 feet wide, while that between m and L is 200 feet also between g and the vertical cliff H, on the east side of the channel, is 290 feet.

Continuing the large curve L, OO, n southward to R, there is, on the east side, a long, straight bluff, SS, 45 feet high at the present river front, and gradually decreasing to about 8 feet at its southern end. On the high ground between X and this channel there is a light drift covering as indicated by the dotted portion. This drift covers the west wall of the channel except at Y, where the rock is exposed. At YY there is no escarpment, but the high hill presents a very distinct curve as is shown by the contour lines. Between Y, YY, Z and the double cross, there is a low drift plain with a form shown by the contours. The river does not follow this low gap which is nowhere over 15 feet above its present level, but has cut a channel through the rocky spur H and S, 300 feet wide and 45 feet deep to present water level. The river here has about 30 feet of water.

At K is a rock with 25 feet vertical front, and at T a rocky projection 45 feet high, through which the river has also cut, while there is an open channel 350 feet wide between K and HH, obstructed only by a gravel trail 15 feet high, extending from K to a low rocky exposure at KK.

The rocks S and T are also separated by a channel about 250 feet wide, presenting vertical walls for a short distance back from the river, and indicated farther south by a depression in the drift filling.

At FF is a high hill with a rock cliff 25 feet vertical. At u u there is a low rock wall which is extended to the dam at F. Wells in the drift terrace south of w show a buried channel there 50 to 75 feet deep.

By tracing out the curves and sigmoids indicated by these rocky walls, evidence is found for two distinct rock gorges, besides the one occupied by the present river, as shown by the heavy, dotted and broken lines respectively.

To make these data as clear as possible, five sections drawn to scales are presented in plate XV. These sections are taken along the lines bearing the same letters on the map and in the same position. The continuous, interrupted and crossed lines represent the courses of the rocky gorges, while the dotted portions represent the estimated depths of the drift-filled channels.

The interpretation of this peculiar locality is by no means certain. We venture an explanation which, in the light of Prof. I. C. Russel's investigations on existing glaciers, seems to me quite possible. There is abundant evidence for believing that the preglacial drainage of Licking County was to the south, and that a great morainic dam backed the water up until it broke over a col into the Muskingum basin.[2]

This col was at the point represented by C at the extreme left of plates XIV and XV. On each side of this low divide there was a ravine cut into the Waverly Conglomerate.

As the water rose over the divide and began to cut it down, the gorge produced by this cutting to the west of the point C

[2] Full description of evidence for these conditions will be found in Bulletin of Scientific Laboratories of Denison University, Vol. VIII, Pt. 2.

conformed exactly to the pre-existing ravine running in that direction, as this ravine would represent continuously the lowest point in the divide, hence we find the upper part of the present gorge showing no marked changes in its position.

The ravine on the down slope toward the east, however, whose outline is represented on plate XIV by the dotted line, and on plate XV by the crossed line, fared quite differently. A large volume of water suddenly attempted to occupy a small ravine. The result was that the first curvature was greatly increased and a great undercut made at X. Deflected from this point it struck the opposite or left bank of the ravine at m, and as it cut farther back into the great curve at OO, it also cut deeper and a small remnent of the left bank of the original ravine was left at m. The outline of this channel is represented by the broken line.

After making the curve at OO where considerable undercutting is also shown, the waters took a straight shoot south into the old ravine again.

At the south end at YY, the old ravine, as shown by the dotted lines, made another sharp curve similar to the one at g, and passed north between S and T to another curve at H H, thus making the next loop of the sigmoid which passed southeast through the point u.

Since the rush of glacial waters was not able to make the short turn at Y Y, and since the original surface level was lower than at H, they broke over the divide and made a new cross channel tending north-east in the direction Z u, and chocked up the old ravine between S and T with sediment. As the lower level was reached and the velocity checked, the lower courses of the intersected ravine were filled up with material cut from the gorge above. Evidence of these buried channels is found in many wells in the village of Toboso, just south of the river dam, which is across the present river at F.

There yet remains the great question, Why the river ever left this second channel which it had cut out at such a great depth and made a new one for itself straight across the rocky barriers at g c′, H S, and K T. If these were at the ends of the loops, or if the old channel was anywhere obstructed with

drift, the explanation would be more simple. As it is, there seems to be but one solution to the problem to suggest, and we believe the facts point very strongly toward its support. This region is just on the eastern border of the Scioto lobe of the ice sheet. No glacial till is reported south or east of this point in Ohio. Does it not seem reasonable then that the great ice front or a local spur of it extended to this point and presented a front along a line represented by the north bank of the river in the line of L, m, g, n, H, K, and F, and remained there long enough for the river waters deflected at X to strike this ice barrier at L m, and, deflected along its front, to cut through the narrow and jointed rocky spurs at KT, then at HS, and last at g c′. If this is true, it will serve as a point in evidence of the probability of ice dams and a point to fix a limit to the ice sheet itself.

For fuller elaboration of the data of this region and other facts in evidence of the very near position of the ice front, see Bulletin of the Scientific Laboratories of Denison University, Vol. VIII, Pt. 2.

EDITORIALS.

—The U. S. National Academy of Sciences has been in a state of paralysis for now two years in the matter of electing members, after having been unable to fill its vacancies for a considerably longer period. This is not due to the lack of suitable candidates, but rather owing to the impossibility of concentrating a sufficient number of votes on any one candidate to elect him. This is in turn due to the fact that there is a disproportionate number of members devoted to the physical sciences, as compared with those devoted to the natural sciences. In the present membership there are, according to a committee of the society, fifty-eight members devoted to the physical, and thirty-one members who represent the natural sciences. It is natural that under such circumstances, the members of the latter class should refuse to add to the members of the former class. It is true that of the seven candidates presented at the election which has just failed, four represented the natural, and three the physical sciences. But the gentlemen present who represent the physical sciences could not be prevailed on to elect an additional member of the division of natural sciences. This result is probably due to a want of concerted action, rather than to an intentional desire to continue the present disproportion between the classes. It is also due in part to the vote of members who do not attend the meetings, and who thus fail to receive information as to various points at issue. The preponderance of any one class naturally tends to perpetuate itself, and its effect is now so conspicuous that the necessity for some change in the mode of elections is obvious.

It is proposed to meet the difficulty by dividing the Academy into classes, each of which is to have a fixed membership, so that deficiencies may be known and filled. Such a system exists in the academies of most countries, and it materially aids in securing a just representation. The system should not, however, be too complex, since it is impossible to fix the correct proportion of membership of any of the special branches of science, which shall be always applicable. A few large divisions, whose cultivators for obvious reasons stand in a generally definite proportion to each other, or to the Academy, is about as much as is practicable in this direction. The committee already referred to, proposes that the Academy be divided into six classes, three of which embrace physical sciences, and two natural sciences, and one includes sciences which cannot be classed under either head. This

classification tends to perpetuate the disproportion already referred to; omits reference to some sciences; and makes no distinct division for applied science. We now refer to a letter addressed to the committee, which appears in the department of Scientific News this number of the NATURALIST, in which the following division is proposed: Class I.—Physical Sciences, 35 members; Class II.—Natural Sciences, 35 members; Class III.—Anthropological Sciences, 15 members; Class IV.—Applied Sciences, 15 members. The sciences included in each of these classes are enumerated in the letter in question.

—A bill has been recently introduced into Congress, providing for the establishment of a "National Academy" of twenty-five members. Of these Congress is to appoint the first five members, and these are to appoint the other twenty. These twenty-five are to represent "literature, science, fine arts and invention." We understand that Gen. Lewis Wallace has drawn up the bill.

The sponsors of this project appear to be unaware of the existence of the National Academy of Sciences of one hundred possible members. They also display an extraordinary exclusiveness in entertaining the supposition that the departments of human effort mentioned in the bill can be properly represented by only twenty-five men. Taking the National Academy of Sciences for granted, it might be supposed that an Academy of Arts might be similarly constituted. In such a case, membership, as in the Academy of Sciences, would be awarded on account of original work done. Literature, Music and the Fine Arts would be encouraged by such an organization, were the qualifications for membership and the number of members strictly defined. The difficulty in doing this, and in applying the rules in the concrete, would be greater in the case of the arts, we apprehend, than in the case of the sciences. It is also quite probable that fifty names, rather than one hundred, would embrace the list available at the present time in this country.

It is hardly possible that the bill now before Congress can become a law in its present shape. The scientific element must be eliminated as being already provided for. The best literary men and artists of the country must decide whether such a body could be so constituted as to be truly representative of the best work or not. Geographical claims, so dear to the American heart, must be ignored in this matter, as it is in the Academy of Sciences; and the usual preference of most people for their friends will be an ever present difficulty to be met and overcome. On the whole, however, we suspect that such a body, properly

protected, would be an encouragement to original production in the arts, as the Academy of Sciences is to those engaged in the pursuit of scientific research.

—THE recent celebration at Jena, in commemoration of the sixtieth birthday of Professor Ernst Haeckel, was a deserved compliment to a great naturalist. The range of Professor Haeckel's work covers the three fields of usefulness possible to the naturalist, viz.: special work, generalization, and popularization. His well known researches on the Radiolaria, sponges, corals and Medusæ are monuments of industry and skill. His generalization of the phenomena of the earliest embryonic stages is the frame-work of embryology. His speculations as to the phylogeny of the Vertebrata have been often confirmed by paleontology. His delightful Travels in Ceylon have brought him before a wide and interested public.

PLATE XIII.

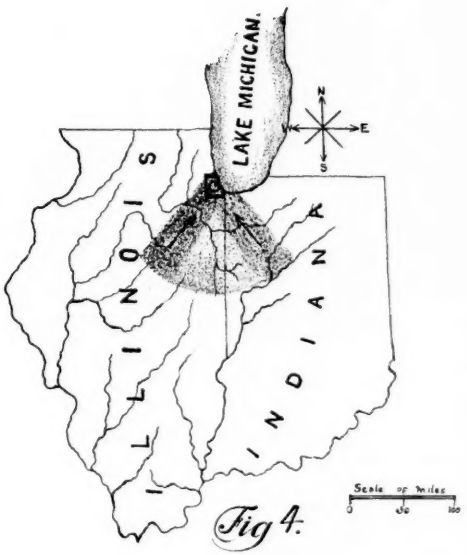


Fig 4.

Fig 1.

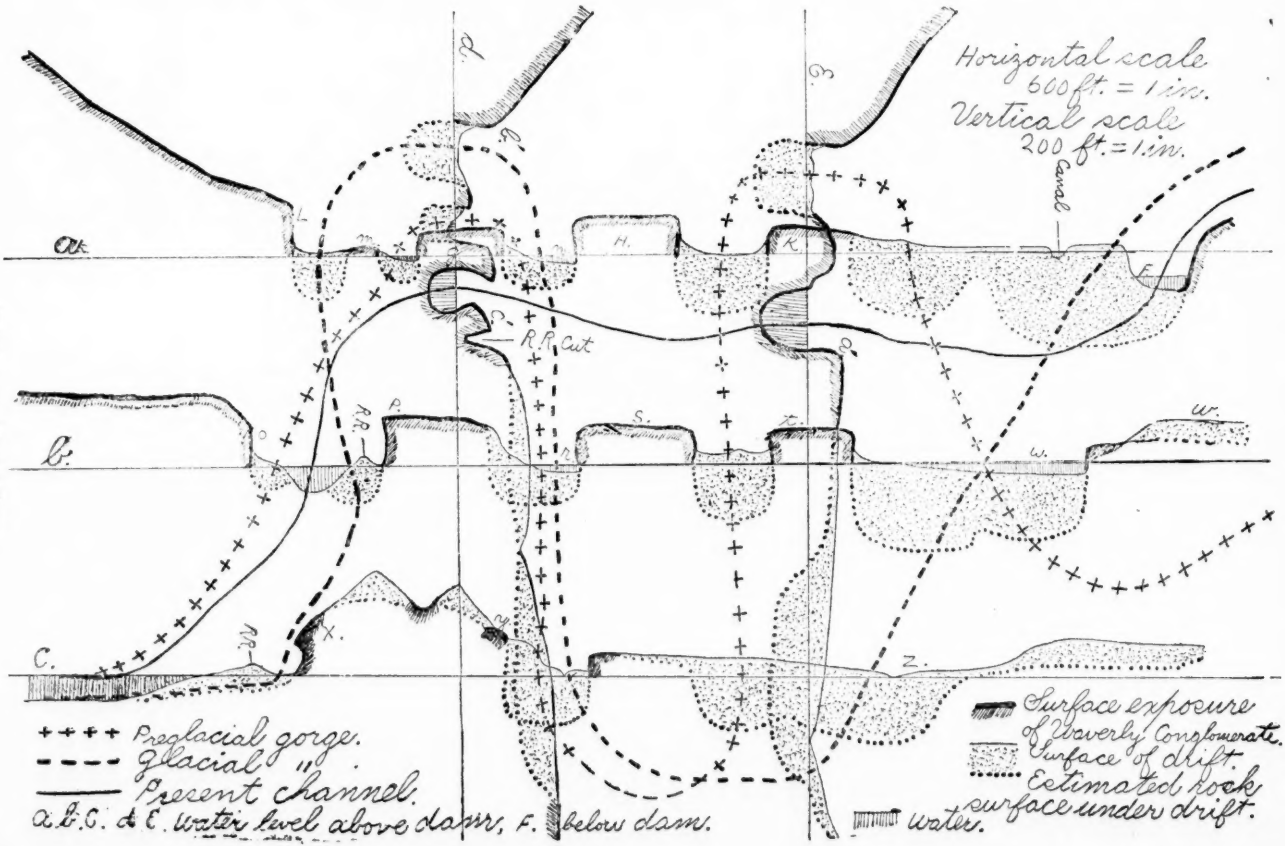
Fig 2.

Fig 3

Tettigidea and its Migrations.

PLATE XIV.

Tight on a Glacial Dam.



Tight on a Glacial Dam.

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RECENT LITERATURE.

The Woods Holl Lectures.[1]—It is with pleasure that we welcome the second of the series of lectures delivered at the Woods Holl Laboratory, for they deserve a larger audience than that for which they were especially prepared. In the present volume we have ten lectures, each adequately illustrated, most of which are devoted to the presentation of the newest thought upon subjects which are most prominent in the biological world to-day. They are, moreover, not résumés of others' work but actual contributions to knowledge by original investigators. In his lecture on the "Mosaic theory of Development," Professor E. B. Wilson, admitting that the extreme form of this theory is untenable, endeavors to show that in a modified shape it contains elements of truth, "that we may consistently hold with Driesch that the prospective value of a cell may be a function of its location and at the same time hold with Roux that the cell has, in in some measure, an independent power of self determination due to its inherent specific structure." Professor E. G. Conklin discusses certain phenomena in the fertilization of the ovum of Crepidula, a form which is especially favorable for the study of the archoplasmatic structures, which he maintains are even more important in the phenomena of impregnation and mitosis than the nucleus, taking as they do the initiative in all the wonderful manifestations of fertilization and cleavage. Further he advances the thesis that the nucleus and especially the chromatin is not of necessity the sole bearer of heredity, a position, which if proved to be true, destroys the whole fabric of Weismann's evolution, as at present constituted.

The third lecture by Professor Jacques Loeb, of Chicago University is upon some facts and principles of what he terms physiological morphology. First he deals with heteromorphosis, that is, describes his experiments with certain Hydroids, there, by reversing the positions, etc., he was able to make roots produce polyps and the free end to grow roots. Next he outlines his experiments with other forms in which there was marked polarity. The third subject is the effect upon certain forms of a change in the density of sea water, while the fourth deals with the production of double and multiple monstrosities in sea urchins, by putting them a short time into diluted sea water and then

[1]Biological Lectures delivered at the Marine Biological Laboratory of Woods Holl in the summer session of 1893. Boston, 1894. 8°. pp. 242, $2.15.

back into normal. In the concluding section, all life phenomena are referred back to chemical processes.

Under the title Dynamics in Evolution, Professor Ryder reiterates his mechanical ideas, explains the changes in form of an amœba by differences of surface tension and this again by chemical action. He has no sympathy with "biophores" and "gemmules" and thinks that experimental investigation in embryology will make no firm progress until the mischievous influences of those speculations which deal with "germ plasms" and the like have been entirely eradicated from the present generation.

Dr. Watase, treating of the nature of cell organization, thinks it not improbable that in the cell we have a symbiotic structure, the nucleus and the cytoplasm living together in a way analogous to that presented by the algæ and the fungus in the lichen. Professor Whitman's lecture on the Inadequacy of the Cell Theory of Development is most suggesitve, but is so condensed as to be beyond any adequate abstract. In a word it is that in our discussions of the cell as a unit, especially in the experimental embryological researches, the tendency has been to regard the cell as all in all, while in reality the whole organism is the entirety.

The thesis which Dr. Howard Ayers maintains in his study of the Pacific Hagfish *Bdellostoma dombeyi*, are that this form is very variable and that the number of gill slits cannot be used as a criterion for separating genera and species; further that it is a primitive rather than a degenerate type; and lastly that a study of the ears of this animal show that these organs cannot be considered as organs of equilibration.

The next two lectures touch upon the Botanical side. Dr. W. P. Wilson discusses the influence of external conditions on plant life and presents an essay which goes far toward showing that such striking acquired characters as the knees of the bald cypress are not inherited but will disappear in a single generation with changed conditions, and that the same is true of the remarkable roots of the Black mangrove of Tropical America. The other botanical lecture, by Professor J. Muirhead Macfarlane, treats of irrito-contractility in plants, in which he shows that this phenomenon is much more common than is ordinarily supposed, but that there is usually a latent period and that in many instances the stimulus has to be repeated before marked manifestations are produced.

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by a general statement, by the Director, Professor C. O. Whitman, of the work and aims of the laboratory from which we learn that already 75 papers have been published, the direct outcome of the laboratory in its six sessions.

The volume is well printed and we look for a large sale for it, for it certainly should be in the hands of every one who wishes to keep himself informed of the present tendencies of biological science.

Report of the United States Fish Commissioner for 1889-91.[2]—This volume contains in addition to the official report of the Commissioner, the results of inquiry respecting Food-fishes and the Fishing grounds of the United States, by Richard Rathbun, and a statement of the Methods and Statistics of the Fisheries, by H. M. Smith. together with six papers published as appendices to the report. Among these is Hæckel's "Plankton-Studien," A Comparative Investigation of the Importance and Constitution of the Pelagic Fauna and Flora, translated by George W. Field.

Mineral Resources of the United States, 1892.[3]—This volume shows the progress made in the development of the mineral products of the United States in 1892. The statistical tables are carried forward from former reports to the close of 1892, but the descriptive matter has been brought up to a late date in 1893.

[2]Report of the United States Commissioner of Fish and Fisheries for 1889–91. Washington, 1893.

[3]Mineral Resources of the United States for 1892. David T. Day, Geologist in Charge. Washington, 1893.

General Notes.

GEOGRAPHY AND TRAVELS.

The Grand Falls of Labrador.—For many years vague reports of a great waterfall in Labrador near the head waters of the Grand River have induced men to explore the interior plateau of this region, but no satisfactory account has been given of the appearance of the "Falls" until the recent publication of the results of an exploration undertaken by Mr. Henry G. Bryant of Philadelphia to verify the reports as to the height and location of this natural wonder.

In company with Prof. Kenaston of Washington, D. C., Mr. Bryant arrived at Rigolet in Hamilton Inlet, July 23d, where they embarked on a small schooner which carried them to the head of the interior basin known as Melville or Grosswater Bay. Here Mr. Bryant tried for Indian coöperation in his enterprise but could not overcome their superstious fears. They firmly believe that death will soon overtake the venturesome mortal who dares to look upon the mysterious cataract. The party that finally started up the Grand River on August 3d consisted of Mr. Bryant, Prof. Kenaston, John Montague, a young Scotchman, and Geoffrey Ban, a full-blood Eskimo. The trip was made in a strong river boat eighteen feet in length and they took with them a canoe for use in the upper reaches of the river. By noon of the second day the party reached Muskrat Falls, where a chain of hills encroaches the bed of the river, contracting the channel and presenting a rocky bulwark, through which the stream has forced its course. The drop of the falls was ascertained to be thirty-six feet. Here was necessitated the first carry, a tedious operation which occupied a day and a half. The subsequent advance of about 175 miles up the river was by the method known as "tracking." That is, a rope was tied to the gun-wale just aft the bow. To the shore end broad leather straps were attached. This constituted a harness for three of the men who tugged away along the rocky back while the fourth man, by means of an oar lashed to the stern, steered a devious course among the rocks and shallows of the river. Sandy banks and glacial boulders insecurely lodged afforded a precarious footing for the "team," and stretches of rugged cliffs exercised their ingenuity in making progress. Wading in the water was often the only resource.

On the fourth day Porcupine Rapids was reached, a distance of fifty-seven miles from the mouth of the river. Here was a notable increase in the size of the firs and spruces. Deposits of magnetic iron ore were observed on the banks of the river. The next day the travellers passed through a widening of the river known as Gull Lake. This is a favorite resort of the Canada goose and its waters contain large numbers of white-fish, pickerel and suckers. Above the lake the valley of the river contracts gradually; the sandy terraces disappear, and sloping banks, strewn with erratics, are encountered for many miles. The Gull Island, Horseshoe, Minnipi and Mouni Rapids were conquered in turn. In the swollen condition of the river, the struggle with these wild rapids was long and stubborn. Mouni Rapids extend over a longer distance than any of the others, and aneroid readings show a greater drop here in the bed of the river than at any other point. It was here that the travellers met with an awkward adventure, which Mr. Bryant relates in the following graphic manner.

"We were approaching a rocky point past which the water dashed with angry violence. It was our custom on reaching such a place to first detach the canoe, and then shove out the boat obliquely from the still water to allow her bow to fairly meet the swifter current. On this occasion, while Montague and I, facing up stream were waiting on the bank above for the signal to advance, the boat, through some carelessness, was pushed out from the quiet eddy squarely into the swift water. The full force of the torrent struck her abeam, and away she swept down the stream like a thing possessed. Taken unawares, no time was given to throw off the leather straps from our shoulders, and instantly we were thrown from our feet and dragged over the rocks into the river by the merciless strength of the flood. Most fortunately for me, the circular strap slipped over my head as I was being dragged through the water. Montague's also released itself, and the runaway sped down stream a quarter of a mile before it was stopped. On clambering up the bank I found Montague stunned and bleeding from a scalp wound. Aside from some abrasions of the skin, I was none the worse for my shaking up, and after a brief delay Montague revived and we resumed our 'tow-path' exercise."

Lake Wanakopow was reached August 20th. This romantic sheet of water, less than a mile in width but 35 miles in length, is surrounded by low mountains of granite and gneiss, from whose cliffs and wooded headlands cascades leap into the lake, their silvery outlines contrasting with the environment of dark evergreen foliage. A sounding taken near the middle shows a depth of four hundred and six feet. Mr.

Bryant considers this narrow elevated basin to be of glacial origin, the presence of great numbers of boulders and the rounded appearance of the hill summits pointing to a period of ice movement.

The middle of Lake Wanakopow marks the limit of Mr. Holme's exploration. On his map he places the Grand Falls thirty miles above the head of the lake, with the river entering the lake from the west. Mr. Bryant found, however, that the river enters from the southwest, and the distance from the lake to the rapids below the fall is fifty-three miles.

Finding it impossible to draw the boat through the wide shallow rapids which they afterwards found extended for twenty-five miles before the fall, the explorers resolved to find an old trail they had heard of from a reliable Indian at the Northwest River Post, which leads from this point on the river through a chain of lakes on the table-land, thence to the waters of the Grand River some miles above the Grand Falls. The plan was to follow the old trail for several days then leave it and strike across country in the direction of the river.

A search of three days for the trail was at last successful and the party advanced across five lakes and four "carries." At the north-western extremity of the sixth lake they left the trail and prepared for the tramp across country, which, according to Mr. Bryant, is of the most desolate character. It is undulating, sparsely covered with stunted spruce trees, Labrador tea-plants, blue-berry bushes, etc., among which great weather-worn rocks gleam, while on all sides white patches of caribou moss give a snowy effect to the scene. Shallow lakes reflect the fleeting clouds, their banks lined with boulders, and presenting a labyrinth of channels and island passages. Low hills rise at intervals, but the general effect of the landscape is that of, flatness and monotony. No living thing was encountered. Just before sunset a column of mist rising like smoke against the western sky proved the accuracy of their reckoning, but it was impossible to reach the river that night.

The next day, Sept. 2d, after a rough march over rocks and bogs, they emerged from the forest near the spot where the river plunged into the chasm with a deafening roar. The following description by Mr. Bryant is so vivid that we cannot refrain from quoting it entire.

"Standing at the rocky brink of the chasm, a wild and tumultuous scene lay before us, a scene possessing elements of sublimity and with details not to be apprehended in the first moments of wondering contemplation. Far up stream one beheld the surging, fleecy waters and tempestuous billows, dashing high their crests of foam, all forced onward with resistless power towards the steep rock, whence they took their wild leap

into the deep pool below. Turning to the very brink and looking over, we gazed into a world of mists and mighty reverbations. Here the equisite colors of the rainbow fascinated the eye, and majestic sounds of falling waters continued the pean of the ages. Below and beyond the seething caldron the river appeared, pursuing its turbulent career, past frowning cliffs and over miles of rapids, where it heard 'no sound save its own dashings'. The babel of waters made conversation a matter of difficulty, and after a mute exchange of congratulations, we turned our attention to examining the river in detail above and below the Falls."

"A mile above the main leap, the river is a noble stream four hundred yards wide, already flowing at an accelerated speed. Four rapids, marking successive depressions in the river bed, intervene between this point and the Falls. At the first rapid the width of the stream is not more than one hundred and seventy-five yards, and from thence rapidly contracts until reaching a point above the escarpment proper, where the entire column of fleecy water is compressed within rocky banks not more than fifty yards apart. Here the resistless power is extremely fine. The maddened waters sweeping downwards with terrific force, rise in great surging billows high above the encompassing banks ere they finally hurl themselves into the gulf below. A great pillar of mist rises from the spot, and numerous rainbows span the watery abyss, constantly forming and disappearing amid the clouds of spray. An immense volume of water precipitates itself over the rocky ledge, and under favorable conditions the roar of the cataract can be heard for twenty miles. Below the falls, the river turning to the southeast, pursues its way for twenty-five miles shut in by vertical cliffs of gneissic rock which rise in places to a height of four hundred feet. The rocky banks above and below the falls are thickly wooded with firs and spruces, among which the graceful form of the white birch appears in places."

Attempts to secure photographs of the falls did not meet with success, it was difficult to obtain a good point of view, and, besides, a combination of poor light and mist from the falls cause a lack of definition in the photographs.

Prof. Kenaston found by measurement that the height of the main fall is 316 feet and the vertical height of the chute is 32 feet; making the total descent from the head of the chute to the surface of the water in the chasm about 348 feet. The Grand Falls are then nearly twice as high as Niagara, and are only inferior to that cataract in breadth and volume of water.

The appearance of the sides of the gorge below the falls and the zigzag line of the river suggests that the falls have receded from the edge of the plateau to their present position, a distance of twenty-five miles. If it has taken six thousand years to cut the Niagara gorge where the water acts on a soft shale rock supporting a stratum of limestone, what an immensity of time is involved in assuming that the Grand River Cañon has had a similar history when it is remembered that the escarpment of the Labrador Falls is of hard gneissic rock.

Among the results obtained by the expedition are the measurement of the height of the Grand Falls; the determination of the altitude of the table-land of southeastern Labrador; map of the lower course of the Grand River, from compass survey; meteorological observations extending over the six weeks of the journey; botanical collections illustrating Labrador flora; ethnological collections illustrating life and customs of mountaineer Indians and Eskimos. (Bull. Geog. Club vol. I, no. 2, 1894.)

GEOLOGY AND PALEONTOLOGY.

Continuity of the Glacial Epoch.—The question of *Pre*-glacial or *Inter*-glacial erosion of the rocky gorge of the Ohio River and its tributaries is made the subject of a paper by Rev. G. Frederick Wright in the Am. Journ. Sci., March, 1894. The writer, as it is well known, maintains the former theory, and gives the following summary of the course of events connected with the Glacial period, stating more fully than has heretofore been done how those who question the long interglacial epoch can account for what has been called the moraine of the second Glacial epoch, and for the river terraces which everywhere, east of the Mississippi River, head near the moraine

"1st. The earlier portions of the Tertiary period were characterized, throughout all the northern hemisphere, by low altitude of land and a warm temperature even in close proximity to the pole."

"2d. A period of slow continental elevations of the regions which are now covered by Glacial drift, extending through some hundreds of thousands of years, was in progress late in the pliocene epoch. During this stage of events, the fiords which characterize the northern portions of both Europe and America, and the extensive rock gorges, like those of the upper Ohio River and its tributaries, were eroded."

"3d. Contemporaneously with this continental elevation at its maximum stage, and chiefly as a consequence of it, Glacial conditions characterized all the higher latitudes of North America and Western Europe. In eastern North America, the center of Glacial radiation was in the vicinity of James Bay. A land elevation of three or four thousand feet would perhaps have been sufficient to produce the Glacial conditions; but the accumulation of the Glacial ice would eventually raise the surface several thousand feet higher."

"4th. Before the climax of the Glacial period, and perhaps in consequence of its burden of ice, the glaciated area began to sink until the land was, north of the Great Lakes at any rate, several hundred feet, at least, lower than it is now. But for some time after the beginning of the subsidence of the land, the rate of accumulation of ice would be greater than that of the subsidence, so that the general level of the glacier continued to rise. Thus the maximum extension of the ice field was actually reached but a short time before the decline of the period set in."

"5th. As suggested to me by Mr. Upham, 'The frontal slope of the ice surface was then less steep than when the warmer climate, bringing the end of the Glacial period, had begun to melt away the southern border.' At the maximum of extent, the slope may be represented as terminating in a very gentle declivity, allowing some transportation of bowlders to the boundary, but not generally so steep as to produce there any well defined moraine. In the glacial recession the warm sunshine and rains were especially efficient, on a belt a few miles or a few tens of miles wide adjoining the boundary, so that when any temporary colder series of years caused a halt or slight re-advance, a moraine would be formed."

"6th. From the time the ice first entered the headwaters of the Allegheny, the Susquehanna, and the Delaware Rivers, the silting up of their channels began. This was effected largely by means of the excessive amount of the Glacial debris brought within reach of the streams. But during the earlier retreat of the ice front from its maximum extent, the silting was facilitated by the differential northerly depression, which existed. During a part of this time, also, it was facilitated in the Ohio Valley by the Glacial dam at Cincinnati."

"7th. After some thousands of feet of ice had melted off, relieving the land from a large part of its burden, the re-elevation of the continent began; (and, as probably the most of the sedimentation of the pre-glacial river gorges had been effected during the earlier portion of this period of recession), there was then an indefinitely prolonged period of reëxcavation by continuous torrents of comparatively clear water, facilitated in the Ohio Valley by the wearing away of the Cincinnati dam, which increased by so much the gradient of the stream."

"8th. When equilibrium had been established again, the land was at about its present altitude, but was still covered to a considerable depth with ice north of the most prominent moraines. The great size of these moraines is partly due to the vast amount of englacial material held in the lower strata of the ice."

"9th. The deposits of the so-called Champlain epoch near the margin of the glaciated area were considerably earlier in time than those which settled over the Champlain Valley itself, since no deposits could take place there until the ice had retreated from the area; but these deposits are properly classed together as Champlain, since they belong to one epoch of general movement."

"10th. So great a complication of causes was connected with the production of all the phenomena connected with the period, that there

were doubtless many oscillations of the ice front, both during the general advance and the general retreat of the ice sheet. The extent and continuance of these oscillations is to be learned from study of the buried forests and vegetal deposits which lie between the earlier and later sheets of till, and by such instances of erosion as may be clearly proved to be inter-glacial. But there does not seem to be evidence of any oscillations of the front sufficient to break the proper continuity of the period."

The Colorado Formation and its Invertebrate Fauna.[1]—In a study of a collection of fossils from southern Colorado, Mr. T. W. Stanton found it necessary to review, not only the species definitely assigned to the Colorado Formation, but also a number of doubtful ones vaguely referred to the Cretaceous of Utah and New Mexico. The results of his investigations are published as Bull. No. 106 of the U. S. Geol. Surv., an octavo volume of 189 pages, and forty-five plates. In the compilation of the species, the nomenclature and descriptions have been carefully revised in all cases where better collections or additional facts seemed to make it necessary. Thirty-nine species are believed to be new to science. Mr. Stanton gives a comparison of the lists of fossils to show that the invertebrate fauna of the Colorado formation cannot be subdivided into the well defined zones recognized in Europe, but the fauna on the whole may be regarded as the approximate taxonomic equivalent of the Turonian.

New Polyzoans from the Belgian Cretaceous.—Mr. Ed. Bergens is about to publish a descriptive work with plates of the Cretaceous Polyzoans collected near Limbourg, Belgium. In this work the author figures a score of colonies from the Maestricht formation (Fox Hills) of great rarity. Among the known species is an example of *Lichenopora diadema* Gldfs. with an ovarian cell completely developed; an entire colony of *Camerapora;* a colony of *Retecava clathrata* Gldfs. with the base rounded, figured in this rolled state as *Neuropora cretacea* by Von Hagenow.

The other forms are new and many of them are referred to new genera. The author recognizes the genus *Eschara*, although it is composed of heterogenous elements, in order not to augment uselessly the synonomy, for a study of the soft anatomy has not yet allowed a definite classification to be made. (Bull. Soc. Belge de Geol. Pal. et Hydrog. T. VII, 1893).

[1]Bulletin United States Geological Survey, No. 106. The Colorado Formation and its Invertebrate Fauna. T. W. Stanton. Washington, 1893.

Geological News.—GENERAL.—In regard to the term gneiss, Professor T. C. Bonney remarks that it covers a group of rocks rather different in character and very different in history. One (a common type) is a gneiss in consequence of an original structure, and remains very nearly in its original condition. Another (also common) owes its structure to pressure acting on a rock which had already solidified and had become crystalline. The Central Oberland and some parts of the Pennines afford examples. A third (rather rare and exceptional) is the result of the metamorphism of materials which were originally clastic. Such has been the origin of some of the banded gneisses in Sark, and more evidentally in a mass of rock near the base of the Allalin glacier where veins of intrusive granite exhibit a banded structure which can only be explained by a movement of the material while still in a plastic condition. (Geol. Mag., March, 1894.)

ARCHEAN.—According to Mr. Robert Bell, many of the long straight valleys in the Archean regions of Canada now occupied by river stretches, by long, narrow lakes, and by inlets of larger lakes are due to the decay and removal of wide greenstone dykes, together with belts of rocks between them. The writer instances the inlets of the northern part of Georgian Bay, Onaping Lake, Long Lake, Sepiwesk Lake with Nelson River, Mattagomi River and Lake Temiscaming. The latter is from one to two miles wide and has a length of 35 miles, but the channel is continued into Deep River. The writer estimates the depth of this excavation to be about 2,600 feet. Mr. Bell presents stratigraphical evidence to show that this valley existed before the date of the Niagara formation, and he believes that most of the valleys which mark the courses of the decayed dykes were formed before the deposition of the Paleozoic strata. (Bull. Geol. Soc. Am., Vol. 5, 1894).

Dr. U. S. Grant concludes, after study in detail of the granitic area near the eastern extension of the Mesabi range in Minnesota, that the rocks of this region are not altered sediment as has been thought heretofore, but that they are truly eruptive in nature and origin. They are sharply separated from the surrounding clastics, and of later date than those. (Ann. Rept. Minn. Geol. Surv. for 1892).

PALEOZOIC.—Among the Silurian Trilobites described by Messrs. R. Etheridge, Jr. and John Mitchell in Proc. L. S. N. S. W. issued March, 1894, are three new species: *Cyphaspis yassensis, C. horani* and

C. rotunda. The first is of interest as being the only Australian Trilobite in which the supposed auditory organs have been observed. These pores in *C. yassensis* are not situated in the facial sutures, but between them and the front rounded border of the glabella.

The Illinois State Museum has just issued a Bull. (No. 3, 1894) containing descriptions of new species of Invertebrates from the Paleozoic rocks of Illinois and adjacent States, described by Messrs. S. A. Miller and Wm. F. Gurley. The fossils comprise 4 species of Echinida, 49 Crinoidea and 4 Crustacea, referred respectively to 2, 29 and 2 genera. Eight page plates of drawings accompany the text, some of which are not as well executed as one would wish.

MESOZOIC.—In a revision of the genus *Cycadeoidea* Buckland, Dr. Lester Ward refers to the collection of six fine cycadean trunks recently found near Hot Springs, South Dakota. All the cycadean remains thus far found in the southern part of the Black Hills occur in the area marked by Professor Newton as Dakota Group. The fact that no cycadean vegetation has yet been found in the extensive collections from the Dakota group of Kansas and Nebraska, led to a careful examination of the series thus classed by Professor Newton, which results in the following conclusion. The Dakota group of Newton is much more extensive than No. 1 of Meek and Hayden, and while the upper portion certainly belongs to the true Dakota, the lower portion very probably extends to near the base of the Cretaceous. The cycadean trunks belong to this lower portion, and may not differ greatly in age from those found in Maryland described by Tyson. (Proceeds. Biol. Soc. Wash., Vol. IX, 1894).

A collection of Cretaceous plants from Vancouver Island yields 50 species of which 27 are new. These are described and figured by Sir Wm. Dawson in Trans. Roy. Soc. Canada, Sect. IV, 1893. In this connection the author points out the value of fossil plants as indicators of climate and time.

CENOZOIC.—A restoration of *Aceratherium fossiger* Cope has been made under the direction of Professor Williston for the Kansas University Museum. The skeleton is a "composite" made up, probably, of nearly as many individuals as there are bones. The different elements were selected from among many hundreds of specimens obtained from a fresh water Pliocene deposit near Long Island, Kansas. The

dimensions of the skeleton are as follows: Length, not including tail, 9 feet; height, 4 feet; greatest girth, 9 feet 4 inches. (Kansas Univ. Quart., April, 1894).

In discussing the mammoth remains in Canada and Alaska, Dr. G. M. Dawson notes that in the northwestern part of the continent they are abundant in, if not confined to the limits of a great unglaciated area there existing. This area comprises nearly the whole of Alaska and part of the adjacent Yukon district of Canada. No *mastodon* bones have been reported from this region. (Quart. Journ. Geol. Soc., Feb., 1894).

A collection of Tertiary Mammals is reported upon by Professor John Eyerman. The most of the specimens were obtained by Dr. Forsyth-Major, *in situ*, in southern France and Italy. The collection comprises 7 Insectivora; 3 Carnivora; 14 Rodentia; and 5 Ungulata. Of the Insectivora, one represents, according to Dr. Major, a new family and genus. Also there is one new genus of Murid rodents, closely related to the American *Paciculus* of Cope. (Am. Geol., Vol. XII, 1893).

Signor G. A. Amicis has just published (Bull. Soc. Geol. Ital., 1893) "I foraminiferi del pliocene inferiore di Trinité-Victor (Nizzardo)," an important contribution to our knowledge of the Pliocene Foraminifera of Italy. One hundred and twenty-six forms are recorded, to each of which a very full and interesting synonymy is given, while only two forms are recorded as new, an evidence of the extreme care bestowed upon his work by the author, who has swept away many varietal forms recently described as new by other authors from imperfect acquaintance with the literature. (Nat. Sci., Feb., 1894.)

In summing up the data concerning the drainage features of the upper Ohio Basin, Messrs. Chamberlain and Leverett agree that the evidence is very strong that the two uppermost sections of the Allegheny basin, (including also Oil Creek Basin) and the middle Allegheny discharged northwesterly; the evidence relative to the lower Allegheny and the upper setion of the Ohio River favors a northerly discharge, but is too incomplete to justify a firm opinion. The authors hold to the belief that no hypothesis of continuity can explain the phenomena of the glacial drift and terraces of the region under discussion. They offer four hypotheses in explanation of the phenomena observed, all of which agree on the most vital points, and all emphasize the importance and significance of the first glacial epoch. (Am. Journ. Sci., Vol. XLVII, 1894).

MINERALOGY AND PETROGRAPY.[1]

Eleolite Rocks from Trans-Pecos Texas.—In a recent report on Trans-Pecos Texas Osann[2] gives a few brief notes on the igneous rocks of the region. The most interesting points in the article, which, on account of the short time allowed the author to prepare it, is little more than a collection of notes, refer to the alteration of limestones by granite and the production of a rock composed almost exclusively of calcium silicates; to the existence of eleolite syenites and phonolites in the Davis Mountains; to the occurrence of a tourmaline schist in the Van Horn Mountains, and of altered diabases and squeezed porphyries in the Carriso Mountains. The eleolite syenite is a fine grained, light colored rock with the typical trachytic structure. It contains orthoclase, eleolite and olivine as phenocrysts and sodalite, aegyrite, malacolite, hornblende, arfvedsonite and the rare minerals ainigmatite, laavenite and pyrrhite in its groundmass. The olivine is nearly colorless in thin section. It usually plays the part of a nucleus around which the other dark components have crystallized. The pyroxene occurs in two generations. The amphiboles are also in two generations, and often these and the pyroxenes are intergrown with their c axes and clinopinacoids coinciding. Ainigmatite is common in the rock, laavenite and pyrrhite are rare. The phonolites fall into two types. Those of the first type are characterized by their fine grain, by the abundance of needles and grains of aegyrite in their groundmass, and the absence from them of amphibole and other accessory components. In the rocks of the second type are a few phenocrysts of feldspar and of nepheline, the latter of which are often bordered by a dark corona of bisilicates. The most prominent of these are aegyrite and malacolite among the pyroxenes and among the amphiboles a variety with a strong pleochroism as follows: A=dark greenish blue; B=dark grayish brown; C=light yellowish brown. Cutting the eleolite syenite are dykes of tinguaite, monchiquite, alnoite, ouachitite, and a rock to which the author gives the name paisanite, since it was found in Paisano Pass in the Davis Mountains. This new rock consists of a few phenocrysts of quartz and of sanidine in a dense white matrix spotted with blue hornblende whose optical properties show it to be riebeckite. The white matrix is composed of

[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2]Fourth Ann. Rep. Geol. Survey of Texas, p. 123.

intergrowths of albite and orthoclase cemented by granophyric quartz. It is unfortunate that the author cannot further pursue the studies so auspiciously begun.

The Differentiation of Rock Magmas.—In a recent number of the *Journal of Geology* are two contributions relating to the theory of the differentiation of rock magmas. One, by Iddings,[3] is a simple statement of the nature of the phenomena that have led to the proposal of the theory. The article does not discuss the causes of the differentiation of magmas except in general terms, but it deals with the facts that seem to indicate that such a differentiation of a homogeneous magma into unlike parts is alone capable of accounting for the great differences observed in the various rocks emanating from a single volcanic center, and in different portions of the same rock mass. The second article, by Backtsröm[4], was written to call attention to the difficuly of explaining magmatic differentiation upon Soret's principle, which applies, so far as we know, only to dilute solutions, and effects only the proportions existing between the solvent and the dissolved body in different portions of a solution. The author prefers to consider rock magmas as mixtures of liquids, some of which are less soluble in others at certain temperatures than at certain different temperatures. Hence if a homogeneous magma cools to a temperature when some of its constituents become difficultly soluble in the mixture of the others, it will become separated into parts possessing different compositions—liquation will ensue. Thus basic concretions are sometimes formed in acid rocks, and the acid and the basic lavas of Iceland occur in numerous flows, side by side, while intermediate rocks are absent.

The Old Volcanics of South Mountain, Pennsylvania.—Miss Bascom[5] has examined with great thoroughness the acid volcanics of South Mountain, Pa., whose existence was made known to the geological public a year[6] ago, and has described briefly the results of her study. These volcanics exhibit many of the features of modern rhyolites in spite of the fact that they have undergone profound alteration since their eruption. Fluidal, micropoicilitic, spherulitic, axiolitic and lithophysal structures are noticed in the various speci-

[3]Jour. Geol., Vol. I, p. 833.
[4]Ib., Vol. I, p. 773.
[5]Jour. Geol., Vol. I, p. 813.
[6]Amer. Jour. Sci., XLIV, p. 482.

mens; perlitic parting is occasionally detected in them; amygdaloidal phases are not uncommon, while taxitic and trichytic structures are frequently met with. The original components of many of the South Mountain rocks have entirely disappeared and in their place are now found only quartz, epidote, magnetite and leucoxene. These minerals are evidently secondary and yet in some specimens they are associated in micropoicilitic intergrowths, thus indicating to the author the secondary origin of this structure in the present instance. The spherelites in the rocks under consideration are often imbedded in a base that was formerly a glass, though it is now a holocrystalline quartz-feldspar mosaic, which must necessarily be of the nature of a devitrification substance, since the mosaic is crossed by delicate perlitic partings. The rocks of the region are thus comparable with the lava flows of more recent age. Some of them were obsidian, others were lithoidal rhyolites and others holocrystalline rhyolites. The structure of the obsidians is now microcrystalline in consequence of the alteration or devitrification processes to which they have been subjected. They are now felsites or microgranites, but their microgranitic structure is not original. It is the result of devitrification. The author would therefor not call the rock a microgranite, nor an obsidian, but would designate it as an apobsidian or an aporhyolite, indicating that it was once an obsidian which has become devitrified—the preposition signifying that the rock to which it is prefixed has undergone alteration of a specific nature.

Another Occurrence of Websterite.—Another occurrence of the basic rock websterite is reported by Harker[7] from Fobello, Lombardy, Italy. The rock is a dark aggregate of black diallage moulding smaller grains of hypersthene. In thin section the diallage is colorless. An eclogite from Port Tana, Norway, consists of garnets holding inclusions of cyanite, omphacite and zircon, imbedded in a groundmass composed chiefly of colorless omphacite and quartz, in which lie phenocrysts of idiomorphic enstatite. A garnet amphibolite from Sutherland, England, a quartz diorite from Viti Leon, Figi, and a uralitized gabbro from Ena, Tonga Islands, are also described by the same author.

Petrographical News.—The nickel ores of Sudbury, Ontario, like those of Norway and Sweden, are associated with gabbro and norite, along their contact with other rocks. The ores are supposed by

[7]Geol. Magazine, VIII, 1891, p. 1.

Vogt[8] to be cencentrations from the magma that yielded the gabbro since the olivine of this rock often contains small percentages of nickel and other comparatively rare metals. The principal ore is a nickel marcasite with 3—5.5 per cent. Ni. The same author describes a nickeliferous pyrite from Beiern, Norway, whose density is 4.6, crystallization regular and hardness 4. It is not magnetic.

A peculiar quartz-porphyry consisting of quartz phenocrysts and crystals of apatite and an altered mineral supposed to be enstatite imbedded in a very fine grained weakly doubly refracting groundmass, which is water clear in thin section except where bespattered with dust inclusions or amorphous iron oxide, is mentioned by Hornung[9] as probably forming a sheet among the diabases and clay slates near Stalberg in the Harz.

Since many of the Maryland granites enclose fragments of other rocks that have suffered contact metamorphism, and since their microscopic constituents possess the characteristics of substances that have solidified from fusion, while the rock masses are intrusive in other rocks Keyes[10] believes he is justified in regarding them all as eruptive in origin.

Piedmontite from a new American Locality.—The rhyolites[11] of the South Mountain region in Pennsylvania and Maryland are characterized by their pink or bright red color, which, according to Williams,[12] is due to the large quantity of *piedmontite* in them. This rare manganese epidote occurs as a constituent in the rock mass, as radiating fibres filling veins and as well terminated crystals enclosed in *scheelite* occupying cavities in the rock. The latter were well enough developed to afford material for optical study. The elongation of the crystals is parallel to *b*. Their pleochroism is *A*=yellow; *B*=amethyst; *C*=carmine. Optically they are identical with piedmontite from other localities. An analysis gave (after correcting for quartz):

SiO_2	Al_2O_3	Ce_2O_3	R_2O_3	Fe_2O_3	Mn_2O_3	MnO	CaO	MgO	K_2O	Na_2O	H_2O	CuO	PbO	Total
37.37	22.07	.89	1.52	4.78	8.15	2.28	18.83	.30	.81	.27	2.48	.13	.17	=100.05

a result indicating that the South Mountain mineral is intermediate in composition between allanite, true piedmontite and mangan-epidote.

[8]Norges Geol. Undersög., 1892.
[9]Min. u. Petrog. Mitth., XIII, p. 373.
[10]Bull. Geol. Soc. Amer., Vol. IV, p. 299.
[11]AMERICAN NATURALIST, March, 1893, p. 273.
[12]Amer. Jour. Sci., 1893, XLVI, p. 50.

The mineral, when in the groundmass of the rhyolite is often associated with a pale rose epidote (*withamite*) and the common green variety, the latter in some cases surrounding the piedmontite. All of the epidotes are supposed to be of secondary origin.

Some American Minerals.—The interesting mineral *rowlandite* from Llano Co., Texas, to which reference has already been made in these notes, has recently been described by Hidden and Hillebrand[13]. Its color varies from bottle green to a pale drab green shade. It is more vitreous than gadolinite, is transparent in thin splinters and it weathers to a waxy brick red substance. The mineral is isotropic. Its hardness is 6 and its density 4.515. An analysis gave:

SiO_2	X	ThO_2	Ce_2O_3	La_2O_3 etc.	Yt_2O_3 etc.	Fe_2O_3	FeO	MnO	CaO
26.04	.39	.59	5.06	9.34	47.70	.09	4.39	.67	.50
MgO	Alk	H_2O	CO_2	Fl	P_2O_5	Total—O=F			
1.62	.28	.24	.34	3.87	tr	= 101.12—1.63 = 99.99.			

Disregarding the CO_2 and CaO and reducing the rare earths to a hypothetical one with the molecular weight of the yttrium group the formula becomes $Si_4\ Yt_4\ Fe\ Fl_2O_{14}$ or $Fe\ (YtF)_2\ Yt_2\ (Si_2O_7)_2$.

Transparent *xenotine* in small crystals associated with muscovite in a quartz pocket is reported by Hidden[14] from near Sulphur Spring, Alexander Co., N. C., and a green variety of the same mineral from the Brindletown gold district, Burke Co., in the same State. The green xenotine has been found only in the gold gravels, forming the interior portions of some of the rough brown crystals intermingled with the sand. It is thought to be original substance from which the brown material was derived by weathering. An analysis of the green mineral indicates a complicated composition:

SiO_2	ZrO	UO_2	ThO_2	Al_2O_3	Fe_2O_3	$(La\ Di)_2O_3$	$(Yt\ Er)_2O_3$	CaO	P_2O_5	F	H_2O
3.46	1.95	4.13	tr	.77	.65	.93	56.81	.21	30.31	.06	.57

In a paper entitled "Minerological Notes" Moses[15] describes *pyrite* crystals from a cavity in limestone at King's Bridge, N. Y. The crystals are octahedral in habit, with the octahedral faces striated parallel to $\infty 0\infty$ and $\infty 02$. On the diploid and pyritoid faces the striations are parallel to their intersections, while the cubic faces are unstri-

[13]Amer. Jour. Sci., XLVI, 1893, p. 208. Cf. also AMER. NAT., 1893, p. 248.
[14]Ib., XLVI, 1893, p. 254.
[15]Ib., XLV, 1893, p. 488.

ated. The same author[16] has analyzed *ettringite* from the Lucky Cuss Mine, Tombstone, Arizona. The mineral is in aggegrates of radiating fibres resembling in appearance a fibrous pectolite. These fibres are doubly refracting and have apparently a parallel extinction. The analysis of selected material gave:

SiO_2	Al_2O_3	CaO	SO_3	H_2O at 115°	Loss at red heat		Total
1.901	10.157	25.615	17.675	33.109	10.872	=	99.329

Reduced, these figures correspond with the formula

$$2\,[(H_{\frac{14}{5}}\,Ca\,Al_2)\,O_3]_2\,SO_3 + 8\,H_2O.$$

Pentlandite occurs at the Sudbury Mine in Ontario, intergrown with massive pyrrhotite. Penfield finds[17] its density to be about 5, and its composition: S = 33.42; Fe = 30.25; Ni = 34.23; Co = .85; gangue = .67. This corresponds to (Fe Ni) S, in which Fe: Ni = 1:1.32. The three supposed new sulphides *folgerite*, *blueite* and *whartonite* described by Emmens from this locality are thought by Penfield to be nickeliferous pyrite (blueite and whartonite) or mixtures of pentlandite with some impurity (folgerite).

Hidden reports[18] two new localities for gem *turquoise*. One is in the Cow Springs district of Grant Co., N. M., fifteen miles south of the Azure Mining Company's claim in the Burro Mountains, and the other is 150 miles east of the Burros in the Jarilla Mountains, Doña Ana Co., in the same State. Both localities were formerly worked by the natives. The matrix of the mineral in both cases is a trachyte traversed by fissures filled with quartz, limonite, kaolin, jarosite and other minerals. The kaolin is the result of alteration of the trachyte and the turquoise is regarded as a further alteration product of the kaolin.

A list of the minerals known to occur in Michigan is given by Hubbard.[19] Among these is a talc which the author calls *beaconite*. It occurs in fibres like those of asbestus, with an index of refraction = 1.5–1.6, an optical angle $2V = 60°$, and a density of 2.74–2.88 Their composition as found by Packard is:

[16]Cf. also Zeits. f. Kryst., XXII, p. 16.
[17]Ib., XLV, 1893, p. 493.
[18]Ib., XLVI, 1893, p. 400.
[19]Rep. State (Mich.) Board of Geol. Survey, Lansing, 1893, p. 171.

SiO_2	Fe_2O_3 . FeO	MnO	MgO	Ign	Total
59.72	8.67	.64	26.42	4.13	= 99.58

corresponding to $H_2 (Mg\ Fe)_3 (SiO_4)_3$.

A pink vitreous *zoisite* found at the Flat Rock Mine, Mitchell Co., N. C., associated with monazite and allanite, has been analyzed by Eakins.[20] Its composition is:

SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	H_2O	Total
38.98	31.02	4.15	.23	23.80	2.03	= 100.21

Specimens of *cacoxenite* from six localities have been examined optically by Luquer[21]. All the crystals show parallel extinction, and a few of the larger ones appear pleochroic in orange and light yellow tints. From a few measurements the approximate axial ratio 1: .75 was calculated.

The *heulandite*[22] from McDowell's quarry, Upper Montclair, N. J., crystallizes in forms agreeing essentially with those of crystals from Baltimore.

The material of the pale green crystals of muscovite from the dolomite of King's Bridge, N. Y., is a mica of the first order. Its apparent axial angle is $2E = 62° 11'$, $2E = 60° 37'$.

Mineral Syntheses.—The ferrous bye-products of aniline factories at Laar, near Ruhort, Westphalia, when dumped upon the ground to dry, are so rapidly oxidized that the heaps soon become too hot to handle. The material hardens and assumes a metallic lustre.[23] On the walls of cavities within it crystals form whose habit is that of *hematite* but whose composition indicates an admixture of hematite with magnetite.

Upon heating to 1200° in a graphite crucible for several hours, one part of titanic iron and two and a half parts of pyrite, Michel[24] obtained a crystalline mass with the properties of *pyrrhotite*. This is filled with vacuoles on whose walls are implanted tiny crystals of *rutile* with the characteristics of the natural mineral.

Monticellite in well developed acicular crystals is reported by von

[20]Amer. Jour. Sci., 1893, XLVI, p. 154.
[21]Ib., 1893, XLVI, p. 154.
[22]A. J. Moses: School of Mines Quart., XIV, p. 326,
[23]Zeits. d. deutsch. geol. Ges., XLV, p. 63.
[24]Bull. Soc. Franc. d. Min., XVI, p. 37.

Gümbel[25] as existing in the slowly cooled silicate slags from the lead furnace at Friehung near Vilseck in Bavaria.

V. Goldschmidt[26] calls attention to the advantage of glass over charcoal in securing sublimates of volatile substances arising during blowpipe analysis. He also gives the description of an apparatus which enables the manipulator to reduce his metallic compounds upon charcoal and collect their sublimates upon ordinary object glasses.

[25]Zeits. f. Kryst., XXII, p. 269.
[26]Zeits. f. Kryst., XXI, p. 329.

ZOOLOGY.

Classification of the Nemertines.—There has been a disinclination on the part of some systematists to adopt the subdivisions—Palaeonemertini, Schizonemertini, Hoplonemertini and Malacobdellini proposed by Hubrecht. Dr. Otto Bürger has returned to the problem, and he proposes[1] the following divisions:

Protonemertini in which the longitudinal nerve cord lies either in the ectoderm or between this and the muscular layer; Mesonemertini in which the cords are in the muscular layer, and Metanemertini in which they are found in the body parenchyma. Bürger further calls attention to "lateral organs" in many species of Carinella. They consist of epithelial discs, sometimes projecting sometimes grooved, richly supplied with nerves, and, although sometimes containing glands, always free from pigment. He halfway expects that some Nemertine will be found in which the whole lateral line is made up of such sense organs.

Ceratodus.—At last we are to have an adequate monograph of this most interesting form. Some years ago the Royal Society of London gave a grant to ascertain its history. An English naturalist was sent to Australia, where he obtained considerable material for an account of this and the Monotremes, but this material has been treated in a regular dog-in-the-manger fashion. Some two or three years ago, aided by funds from the Ritter foundation, Dr. Richard Semon went to Australia with the same object in view, and the results are now beginning to appear.[2] From the first parts we learn that Ceratodus is confined to the middle portions of the Burnett and Mary rivers; that it cannot go upon land, and that it may be caught with a hook baited with almost any animal substance. The native name is given as Djelleh (we had supposed it to be Barramunda). It breathes between 30 and 40 times a minute. The reproductive season lasts from April to the last of November, and is at its height in September and October. The eggs are enveloped in a gelatinous envelope, and their specific gravity is greater than that of water. The segmentation is much like that of Petromyzon and the Amphibia. The development within the egg occupies 10 to 12 days, and the anterior extremities appear 14 days after hatching, the hinder after 2½ months. No fold was observed connecting the anterior

[1]Verh. Deutsch. Zoolog. Gesellsch. III Jahresversammlung, 1894, p. 24.
[2]Deuksch. Med. Nat. Ges. Jena. Bd. iv, 1894, also separate.

and posterior limbs. There are no larval gills nor sucking mouth. Young fish are rarely taken, and those under a foot in length, never.

Some Proposed Changes in the Nomenclature of the American Mammalia.—The changes in nomenclature herein proposed are the outcome of a critical study of the literature and synonymy relating to the Mammals of Ord's Zoology, which was published in Philadelphia in 1815, in the second American edition of Guthrie's Geography.

As already announced in THE NATURALIST (March, 1894, p. 289), a reprint of a recently discovered copy of this extinct work will be shortly issued by the subscriber. In an appendix to this reprint the following emendations are fully discussed. For several of these no claim of originality is pretended, as they only reaffirm the decisions of others which have not hitherto met with general acceptance, but which, after a very careful examination, appear to merit the endorsement of scientists. The Code of the American Ornithologists Union has been made the basis of these determinations.

1. Red, or New York Bat, *Atalapha borealis* (Müller), "Der Neujorker," Natursys. Suppl., 1776 (No. 21) p. 21, antedates *Atalapha noveboracensis* Erxl., Syst., Reg. Anim., 1777, p. 155.

2. Hence "*Vespertilio borealis*" Nilsson, Illum. Fig. Scand. Fauna haft, 1838, p. 19, pl. 36, being preoccupied, will have to stand as *Vesperugo nilssoni* Keys. & Blas., Wiegm. Archiv., 1839, p. 315.

3. Hang-lip Bat, *Noctilio labialis* (Turton), Syst. Nat., 1802, p. 25, antedates *Noctilo abliventer* Spix, Sim. et Vesp. Brasil, 1823, p. 58.

4. Nine-banded Armadillo, *Tatusia novemcincta* (Linnæus), Syst. Nat., 1758, p. 51. *Tatusia peba* Desmarest, Mam., 1820, p. 368, is a synonym.

5. Arctic Walrus *Rosmarus rosmarus* (Linnæus), Syst. Nat., 1776, p. 49. *Rosmarus trichechus* Gill, Johns. Univ. Cyclop., III, 1877, 633, is in violation of the Code. *Odobœnus* Linnæus (1735) not binominal, was not legally used by Malmgren (Ofver K. Vet. Akad. Forh., 1863, p. 130) until after *Rosmarus* of Scopoli (Introd. Hist. Nat., 1777, p. 490).

6. West Indian Manatee, *Trichechus manatus* Linnæus, Syst. Nat., 1758, p. 34. *Trichechus* is only applicable to the Manatee. Linnæus' type of the genus was the West Indian species. *Trichechus inunguis* (Natterer) is the eastern South American species, and *Trichechus senegalensis* (Desmarest), the Old World representative.

7. Northern Gray Wolf, *Canis lupus nubilus* Say, Long's Exp. R. Mts., I, 1823, 169.

Mexican Gray Wolf, *Canis lupus mexicanus* (Linnæus), Syst. Nat., 1766, p. 60.

If we consider the American Wolf a distinct species from the European, and the Mexican animal a subspecies, their names should stand *Canis mexicanus* Linnæus (sup cit.) and *Canis mexicanus nubilus* (Say.) (sup cit.). *Canis lupus griseo-albus* (Sabine) J. A. Allen, is inadmissible. *Canis lupus griseus* Sab. is antedated by *C. griseus* Boddaert, Elench. Anim., 1784, p. 97.

8. American Gray Fox, *Urocyon cinereoargenteus* (Müller), Natursys. Suppl., 1776, p. 29. Müller's name, as in the case (sup. cit.) of *Atalapha borealis*, has priority over Erxleben's *Urocyon virginianus*, Syst. Reg. Anim., 1777, p. 567.

9. American Red Fox, *Vulpes pensylvanicus* (Boddaert), Elench. Anim., 1784. p. 97.

As cited by Gray, Cat. Brit. Mus. Carniv., 1869, 205, this name has long priority over *Vulpes fulvus* (Desmarest), Mam., 1820, p. 203.

10. Canada Otter, *Lutra canadensis* (Schreber). The "*Mustela lutra canadensis*" of Schreber, Saugt., III, 1778, pp. 458, 588, pl. cxxvi, β, has priority over *Lutra canadensis* (Turton) Syst. Nat., 1802, p. 57, to whom this name has been accredited. "*Lutra hudsonica* Lacepede" is a reference I am unable to find.

11. *Ursus americanus cinnamomum* Aud. & Bach., N. Amer. Quad., III, 1853, p. 125, is a synonym of *Ursus horribilis* Ord, Guth. Geog., 1815, p. 291. Both are based on the "Brown" Grizzlies of Lewis and Clark, from the Missouri Valley. These bears should stand as *Ursus arctos horribilis* (Ord). The Pacific Coast Grizzly (if separable) should be named *Ursus arctos horriaeus* Baird, U. S. Mex. B'dry Sur., 1859, p. 24.

12. American Black Bear, *Ursus americanus* Pallas, Spic. Zool., 1780, pp. 6–24. This form, with its brown and yellow variants, is sufficiently constant to remain specifically separable from *arctos*. *Ursus luteolus* Griffith (vid Merriam, Proc. Biol. Soc. Washn., 1893, p. 147), if not distinct from it, is a well-defined variety of *americanus*. Its affinities with *arctos* are much more remote.

13. American Badger, *Taxidea taxus* (Schreber), Saugt., III, 1778, p. 520, pl. 142, β. *Taxus*, in a specific sense, has long been misapplied to the European Badger. Schreber originally gave it to the American species, and his name antedates *Taxidea americana* (Boddaert), Elench. Anim., I, 1784, p. 136. The European Badger will stand as *Meles meles* (Linnæus).

14. "Mexican Shrew, *Sorex mexicanus*" Turton,= Tucan, *Geomys mexicanus* (Turton), Syst. Nat., 1802, p. 72, antedates *Geomys mexicanus* (Lichtenstein), Abhan. K. Akad. Wiss. Berl., 1827, p. 113.

15. Florida Gopher, *Geomys tuza* (Ord), Guth. Geog., 1815, p. 292, has unmistakable right of priority over *Geomys pinetis* Rafinesque, Amer. Mon. Mag., 1817, p. 45.

16. Pennsylvania Meadow-Mouse, *Arvicola pennsylvanica* (Ord), Guth. Geog., 1815; p. 292 (foot-note), undoubtedly refers to same species named *A. riparius* by Ord in 1825. Rafinesque's *Mynomes pratensis*, Amer. Mon. Mag., II, 1817, p. 45, further necessitates retention of Ord's first name.

17. "Small Black Squirrel"(=Black Gray Squirrel), *Sciurus carolinensis pennsylvanicus* (Ord), Guth. Geog., 1815, p. 292.

Ord, in a foot-note, defines the Western Alleghanies of Pennsylvania as the type habitat of this race. As such it represents the *S. leucotis* of Gapper, Zool. Jour., V, 1830, 206, over which Ord's name has priority.

18. Eastern Red Squirrel, *Sciurus hudsonius* (Erxleben), Syst. Reg. Anim., 1777, 414, antedates *S. hudsonius* Pallas, Nov. Sp. Glir., 1778, 376. Credit for this name has been wrongly given to Pallas.

19. Hudson Bay Flying Squirrel, *Sciuropterus volucella sabrinus* (Shaw), Gen. Zool., II, 1801, p. 157. *Sciurus hudsonius* Gmelin, Syst. Nat. I, 1788, 153, can never stand for any *Sciuropterus*, owing to Gmelin's double use of it in the above citation.

20. Columbia Gray Squirrel, *Sciurus griseus* Ord, Guth. Geog., 1815, p. 292 (Mss. marg. note of author); ibid, Jour. de Phys., LXXXVII, 1818, 150, antedates *Sciurus fossor* Peale, Mam. U. S. Expl. Exp., 1848, p. 55. The Californian subspecies will stand *S. griseus nigripes* (Bryant).

21. Red-Breasted Squirrel, *Sciurus rubicatus* Ord (same references as above for *S. griseus*), antedates *Sciurus douglassi* Bachman, Proc. Zool. Soc., 1838, p. 99.

22. Mexican Deer, *Cariacus virginianus mexicanus* (Gmelin), Syst. Nat., 1788, p. 179, is based on the "Teuthlalmacame," Hernandez, Hist. Mex., 1651, pp. 324, 325. The description of the latter does not apply to the Prong-horned Antelope, *Antilocapra americana*, so asserted by Berlandier (Baird, Mam. N. Amer., 1857, p. 666; Alston, Biol. Cent. Amer., 1879, pp, 82, 113). Hernandez's figure of the Teuthlalmacame (p. 324), whether of the Deer or the Antelope (it partly fits both), cannot affect the description, which applies to the Deer, as also Pennant and Gmelin have construed it.

23. Black-faced Wood Brocket, *Cariacus tema* (Rafinesque), Amer. Mon. Mag. I, 1817, 44. Mr. Alston, Biol. Cent. Amer., 1879, p. 118, declares this animal to be the *Cariacus rufinus* Bourc. & Puch., Rev. et Mag. Zool., 1851, p. 561. Reference to the descriptions of Hernandez and Rafinesque confirms this view and seems to justify the retention of Rafinesque's specific name as above.

24. Mountain Sheep, *Ovis cervina* Desmarest, Nouv. Dict. Hist. Nat., 1818, p. 551. *Ovis montana* Cuvier is preoccupied by *Ovis montana* (Goat) Ord. "*Ovis montana* Geoff." is a myth. *Ovis canadensis* Shaw, Nat. Misc. XV, pl. 610, is undated.

25. American Bison, *Bison bison* (Linnæus), Syst. Nat., 1758, p. 72.

26. South American Tapir, *Tapirus terrestris* (Linnæus), Syst. Nat., 1758, p. 74.

—Samuel N. Rhoads.

Zoological News.—Worms.—J. P. Moore describes[3] four new species of Branchiobdella parasitic upon American crayfishes. These differ from all European species in the character of the vasa deferentia.

Louis Joubin has just published a monograph of the Nemertines of France, making an octavo volume of 235 pages, illustrated by four plates.

Rotifers.—H. S. Jennings points out[4] that the genus Plœosoma of Herrick (1885) has, as synonymes, the names Gomphogaster, Gastropus, Gastroschiza, Bipalpus and Dictyoderma. The species which Herrick described as *P. lenticulare* may be the same as *Euchlanis lynceus* Ehrenberg; if not, it is a distinct form. Jennings also states that *P. hudsoni*, of Europe, inhabits Lake St. Clair, as does *Hudsonella picta*.

Mollusca.—P. H. Mason, among other interesting facts states[5] that cases of mimicry and of hybridization are unknown among the shells of molluscs, and that these cannot be invoked as playing any part in the evolution of new forms. He would rather believe that the variations are to explained as depending upon the relations of the animal to the shell and of the whole to its surroundings.

[3] Proc. Acad. Nat. Sci., Philadelphia, 1893, 419.
[4] Zool. Anzeiger, xvii, p. 55, 1894.
[5] Jour. Conch., vii, 328.

Hexapoda.—F. W. Goding catalogues[6] with synonyms 278 species of North American Membracida. The new genera are Evashmeadea and Vanduzea.

Joamny Martin has investigated the place of oxygen in insects.[7] A solution containing indigo in a colorless condition, but capable of becoming blue in contact with oxygen, was injected into the body cavity of various larvæ, and subsequent dissection showed that only in the neighborhood of the finest tracheal branches, where the "spiral filament" is lacking, was the solution colored. Consequently it is only in these regions that oxygenation of the blood can occur.

Hemichorda.—In an article "Who First Found Balanoglosus?"[8] the Rev. A. M. Norman says that Cavolini figures it in the Atlas of Delle Chiaje. To this Carus replies[9] that in the text the figure is said to represent the spiral ovary [the urticating tentacles spirally coiled up] of "Rombo amento," according to Delle Chiaje *Stephanomia uvaria.* Norman replies[10] that Cavolini's figure refers to the "ovary of *Agalmopsis cavolinii.*"

[6] Bull. Illinois State Lab. N. Hist., xiv, p. 391.
[7] C. R. Soc. Philomath, Paris, 24 Dec., 1893.
[8] Ann. & Mag. N. H, xiii, 136, 1894.
[9] Zool. Anz., xvii. Liter. p. 10, 1894.
[10] L. c., xiii, p. 216, 1894.

EMBRYOLOGY.[1]

Ookinesis in Limax maximus.—The observations here given are confined to early stages of the egg while in the oviduct, and before the expulsion of either polar globule. The article, therefore, deals with stages which, for the most part, preceed any discussed by Dr. Mark in his excellent treatise on *L. campestris*.[2]

Of the following wood-cuts, Fig. 1 is a diagrammatic representation of the oviduct from a laying animal, from which eggs were taken, and studied serially as numbered. The vitellus averaged 156.2 μ in diameter.

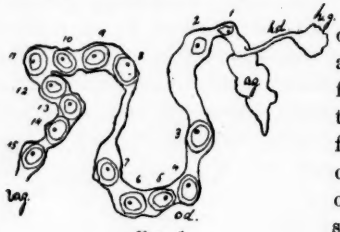

FIG. 1.

Various methods were made use of in fixing—Fols solution: osmic acid, 1 %, followed by Merkel's fluid; chromic acid, $\frac{1}{3}$%, etc., but the one which gave the best satisfaction was as follows: The body cavity of a laying animal was opened by a quick cut of the scissors, and the animal plunged into a boiling hot solution of corrosive sublimate; allowed to remain one minute; transferred to water and eggs removed from oviduct and shelled.[3] Vitellus allowed to remain in distilled water two minutes, then transferred to 35 and 50 % alcohol, remaining three minutes in each grade; then to 70 % alcohol for permanent preservation. I found that if eggs were allowed to remain in distilled water three hours or more, they shelled better, the vitellus coming out clearer and freer. For examination of eggs in toto, Czokor's alum cochineal gave, as a rule, good results. Ten minutes' stay in this dye appeared to give the necessasy differentiation; but for examination of sections much longer time was necessary, two to three hours or more. Picrocarminate of lithium was also found to be excellent, if anything, better than Czokor, on account of its differentiating nucleus structures.

[1] Edited by E. A. Andrews, Baltimore Md., to whom communications may be addressed.

[2] "The Maturation, Fecundation and Segmentation of *Limax campestris* Binney," by E. L. Mark, Bulletin of the Museum of Comparative Anatomy, Vol. 6, parts 11 and 12, Cambridge, Mass, 1881.

[3] In the upper part of the glandular portion of the oviduct there were a number of eggs in which the outer membrane or shell was barely formed, in some, egg No. 1, for example, there was no membrane at all, and in others only the inner membranous coat was present.

For examination in toto, 24 hours in this stain, and then washing with distilled water and pure alcohol gave good results.

Section staining on slide was also found desirable and Safranin was the stain used—2½ hours, followed by acidulated (½ % Hcl) alcohol of 90 % grade for 7–10 minutes.

The Schällibaum should be new, the sections carefully applied to a well smeared slide, and kept at 60° C. for exactly 15 minutes.

If Mayer's albumen fixative is used, only warm, and as soon as paraffine is melted remove slide from heat.

A number of sections of the hermaphrodite duct (h. d. Fig. 1) were made. One egg was found, in this duct, near the hermaphrodite gland, containing two polar corpuscles, each surrounded with a faintly stained Hof, and each showing striae radiating from corpuscle through Hof. About 8 chromosomes were observed irregularly grouped in the well-defined archoplasm of Boveri.[4]

From these sections it appears that the centres of attraction which Garnault[5] says do not exist in the ovarian egg of *Arion* and *Helix*, and which were not seen in the hermaphrodite gland of *L. maximus*, do exist in the duct very near the gland. They evidently appear immediately after the egg has left the ovary. This duct was lined, for the most part, with ciliated epithelium, and contained much mucus.

Fig. 2 illustrates an optical section of egg No. 1 from glandular part of the oviduct (see Fig. 1) viewed obliquely to the long axis of the spindle, and showing the two polar corpuscles and chromosomes, there being about twenty of the latter lying in an irregular cluster in the clear space between the corpuscles. This egg was stained in picrocarminate of lithium for 30 hours. In its examination a Zeiss Oc 2 and Obj. E were used. A broken membrane, "membrane rougée," was seen with apparently chromatic thickenings in it. Observations on this egg coincide closely with those of Garnault on *Arion* and *Helix*, and, in a measure, with those of Vejdovsky on *Rhynchelmis*.[6]

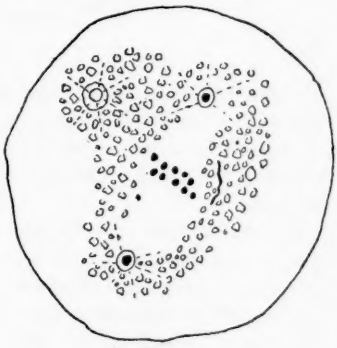

FIG. 2.

[4] "Zellen-Studen" von Dr. Theodor Boveri, Jena, 1887.

[5] "Sur les phénomènes de la fécundation chez l' Helix aspersa et l' Arion empiricorum."—Zoöl. Anzeiger Nos. 297 and 298, Dec., '88 and Jan., '89.

[6] Die Entwecklungsgeschicete der Oligochaeten (*Rhynchelmis*), 1888.

The larger corpuscle is the one nearest the observer. The structural peculiarity of one side of the nucleus should be noted—where cytoplasm and yolk granules are in intimate relation with contents of nucleus. This is Garnault's "prophase;" it is the stage just previous to formation of nuclear plate leading to the forming of first polar globule. In another egg, No. 9, from the same oviduct, an optical section showed rays of hyalocytoplasm pushing out from clear area through granules of vitellus. Chromosomes irregularly placed in hyaline area. Spindle striae observed in viewing the egg at right angles to spindle axis.

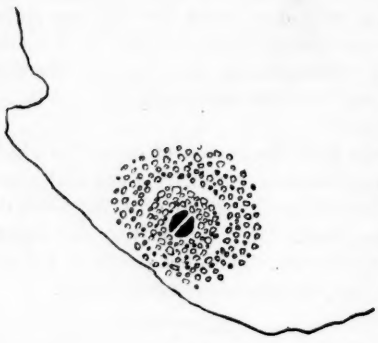

FIG. 3.

Fig. 3 illustrates an optical section of egg No. 11 from oviduct of another animal, occupying the same relative position as No. 11 in the oviduct drawn. In an eccentric position, and near the surface, a clear circular area with radial striae was observed, indicating the presence of the male pronucleus. A portion of the membrane of the germinal vesicle still present. Egg No. 10, in the same animal, also showed circular male area in direction of axis of spindle, and chromatin granules within it. In egg No. 9 the head of spermatozoön was seen in optical section, some little distance from periphery, circular with narrow Hof about it and striae radiating from Hof. Very fine granules were evident within this pronucleus.

Fig. 4 illustrates part of a section of egg shown in Fig. 2, cut in such a plane as to show the sperm nucleus near the periphery. Drawn with Zeiss Oc 1 and $\frac{1}{18}$ oil immersion. Garnault says, in speaking of formation of sperm nucles in *Arion* and *Helix*, "the spermatozoön enters just before first kinesis or immediately after. The contracted head does not begin to change until after the expulsion of the second polar globule. The sperm-head first

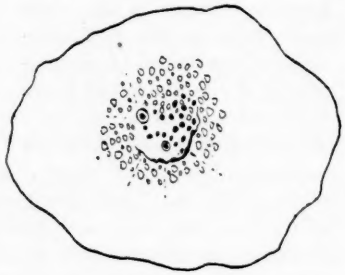

FIG. 4.

divides ihto two chromatin spherules, then, by successive divisions, there is formed a great number of spherules which remain inclosed in a clear areole. This clear areole recalls the hyaline centre of attraction when that has received the half plate for the formation of a vesicular nucleus.[7]

—F. L. Washburn.

[7] The following few notes pertaining to the fixing and staining of *freshly laid* eggs may be of interest.

Eggs placed for 5 minutes in Fol 99 (1 % chromic 25 vol, 2 % acetic 50 vol, H_2O 25 vol) then shelled in water, vitellus in same solution for 5 minutes, H_2O 10 min., and 35 % and 50 % alcohol 5 minutes each, 70 % 30 min. and 90 % ad. lib. gave good results, taking picrocarminate of lithium very well if left long enough in stain. They also took borax carmine very well after the above treatment.

Both of these stains did well after the eggs were immersed in chromic $\frac{1}{3}$ % 10 min., then shelled in large quantity of water, then vitellus in chromic $\frac{1}{3}$ % 4 min., and H_2O and grades of alcohol as above.

Whole egg in osmic acid 1 % 5 min., followed by Merkel's fluid 4 hrs.; shell, then water and grades of alcohol 2 min. each to 70 % for permanent preservation were quite satisfactory. It gave good results as to nuclei when eggs were left in picrocarminate of lithium for 48 hrs.

ENTOMOLOGY.[1]

Tertiary Tipulidæ.—Another important contribution to our knowledge of fossil insects has just been made by Mr. S. H. Scudder, whose Tertiary Tipulidæ[2] is in many respects one of the most satisfactory memoirs upon a fossil family that we have. It is remarkable that a large proportion of the several hundred specimens of these delicate insects collected in the famous Florissant deposits have not only "the venation of the wings completely represented, with all their most delicate markings, but also the slender and fragile legs with their clothing of hair and spurs, and to some degree at least the antennæ and palpi. Even the facets of the compound eyes are often preserved as in life." The nine lithograph plates accompanying this paper show very well the correctness of these statements.

Mr. Scudder describes twenty-nine new species belonging to ten genera of Limnobinæ and twenty-two new species belonging to five genera of Tipulinæ. The general results of his study are summarized as follows:

1. The general facies of the Tipulid fauna of our western tertiaries is American, and agrees best with the fauna of about the same latitude in America, as far as we are at present acquainted with it.

2. All the species are extinct, and though the Gosuite Lake and the ancient lacustrine basin of Florissant were but little removed from each other, and the deposits of both are presumably of oligocene-age, not a single instance is known of the occurrence of the same species in the two basins. The Tipulid fauna of the Gosuite Lake, however, is as yet very little known, and it should be added that the few described species are in no instance the same at Green River, Wyo., and White River, Colo., both localities in the same ancient lake basin.

3. No species are identical with any of the few described European tertiary Tipulidæ.

4. Restricting ourselves to the Florissant basin, from the paucity of material in the Gosuite fauna, it will be noticed that a remarkable proportion of genera (eight out of fifteen) are not yet recognized among the living, these genera including about one-third of the species.

[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

[2] Tertiary Tipulidæ, With Special Reference to those of Florissant, Colorado, By Samuel H. Scudder. Proc. Amer. Phil. Society, vol. XXXII. Reprinted April 4, 1894.

5. With one (American) exception—Cladura—all the exisiting genera which are represented in the American tertiaries are genera common to the north temperate zone of Europe and America, and are generally either confined to these regions or the vast proportion of their species are so confined. A similar climate is indicated, but this latter conclusion should be received with hesitation, since our knowledge of the distribution of American genera is mostly confined to the Atlantic States. There are, however, no certain indications of a warmer climate, such as have been shown from the study of other groups.

6. There are no extinct groups higher than genera, but one or two of these, such as Cyttaromyia and Micrapsis, are of a somewhat striking character.

7. The relative importance of the two subfamilies of Tipulidæ though differing on the two continents of Europe and America both in tertiary and in recent times, was much the same, on each continent, in tertiary times as now; while in the relative preponderance of the different tribes of Limnobinæ, our tertiary fauna shows a somewhat closer agreement with the European tertiary than with the existing American fauna. There are, however, no striking generic alliances pointing in the same direction.

Dr. Packard on Lagoa crispata.—In an important paper presented to the American Philosophical Society[3] Dr. A. S. Packard gives an interesting account of a remarkable moth, accompanied by seven plates of figures. The larva in question is remarkable because it possesses the rudiments of two pairs of abdominal legs in addition to the five pairs usually present in lepidopterous larvæ. In summing up the characters which lead him to consider Lagoa a generalized type the author says: In the superficial characters of the imago and in having in the larva abdominal legs, Lagoa resembles the Liparidæ, but in all its essential characters, those of the egg, larva, pupa and imago, it belongs with the Cochliopodidæ, except in the matter of the presence of abdominal legs in the larva. On this account it seens fairly entitled to be regarded as the type of an independent group. We may either regard it as a generalized ancient group of Cochliopodidæ, and refer it to a subfamily Lagoinæ, or we may boldly remove it altogether from either of the two families mentioned and consider the genus as the representative of a distinct family and designate the group by the name

[3] A Study of the Transformations and Anatomy of *Lagoa crispata*, a Bombycine Moth. Proc. Am. Phil. Soc., vol. XXXII, pp. 275–292.

of Lagoidæ. This on the whole seems to us to be the most judicious course to pursue. At all events the insect is plainly enough an ancient ancestral or generalized form. It is, so to speak, a primitive Cochliopodid with larval abdominal legs. It lays eggs like those of Limacodes, etc.; its head in the larval state is concealed from above by the prothoracic hood; its larval armature is more of the Cochliopodid type than Liparid; so are the pupal characters and the nature of the cocoon; and the shape of the important parts of the head and the essential features of the venation are overwhelmingly Cochliopodid. Under these circumstances we feel justified in regarding Lagoa as a most interesting ancestral form, and as affording arguments for considering the Bombyces, as a whole, as a generalized and ancestral group, and epitomizing the other higher Lepidopterous families somewhat as Marsupials do the placental orders of mammals."

In a note Dr. Packard announces his recent discovery that Lagoa is preoccupied by Megalopyge of Hübner, and Lagoidæ by Megalopygidæ of Berg.

Miss Ormerod's Report.—Miss Eleanor A. Ormerod's seventeenth report on the injurious insects of England which has lately appeared forms a volume of 152 pages treating of a great variety of insect pests. There are a number of illustrations, several being new. The most remarkable insect appearance of last season was the so-called plague of wasps, already mentioned in the NATURALIST. Concerning this Miss Ormerod writes: "The enormous excess of wasp presence over the average was in many places nothing short of a calamity, inflicting pain, and to some degree danger to ourselves, and to horses exposed to sudden attack, and great loss to fruit-growers. Within our houses in many cases the wasps swarmed to such a degree and especially at meal times as to make their presence on the food a real trouble; the agricultural or garden laborers were severely stung where working on crops to which the wasps had been attracted by the presence of aphides, or on fruit stocks where budding was going forward. Also pain, risk and delay in farm work were caused by fierce onslaughts of wasps from nests turned up in plowing. Great losses were caused by the quantity of fruit entirely ruined up to almost wholesale destruction in the grounds of large fruit growers, and to this must added the losses to shop owners dealing in such commodities as find favor in the eyes of wasps for their own consumption, or thievish abstraction for food of the coming on generation still in maggot condition, to be counted by hundreds, in each of the vast number of nests which were the headquarters of the marauding and troublesome pests."

Miss Ormerod attributes the extraordinary abundance of the wasps to the early and long continued drouth which enabled the insects to get an unusual start.

New York Reports.—The Eighth and Ninth Reports of Dr. J. A. Lintner, State Entomologist of New York, have recently been published. They are good sized volumes giving abundant evidence of the pains-taking preparation so characteristic of their predecessors in the same series. The contents of the eighth report include an introductory summary of the important entomological events of 1891; a discussion of a number of injurious insects; notes on various insects and remedies for them; two entomological addresses, and a bibliography of the publications of the entomologist for 1891, 1875 and 1876. The ninth report is equally full of varied and valuable information, and contains besides a reprint of Dr. Asa Fitch's Catalogue of Homoptera which will be appappreciated by many students.

Notes.—Mr. Alex. A. MacGillivray of Ithaca, New York, continues his papers on North American Thysanura in *The Canadian Entomologist.* He advises the restriction of the name Poduridæ to genera having the saltatory organ, and includes the genera in which it is absent under the Aphoruridæ. A number of new genera and species are described.

An interesting colored plate showing the variations of the larvæ of *Arctia caia* appears in *The Entomologists' Record*, Feb. 15, 1894.

Prof. T. D. A Cockerell publishes in Bulletin 10 of the New Mexico Experiment Station a List of Insects found on Cultivated plants in the Mesilla Valley.

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In Bulletins 35 and 36 of the West Virginia, Experiment Station Mr. A. D. Hopkins continues the publication of his studies of wood boring insects. A large number of fairly good original figures are published.

In Bulletin 51 of the Ohio Experiment Station, Mr. F. M. Webster publishes a number of miscellaneous articles. The one of most general interest is on "Some Insect Immigrants of Ohio."

Professor Herbert Osborn announces the discovery[4] that *Aphis rumicis* is the summer form of *A. euonymi,* and gives observations confirming the statement. He also reports upon the relations of the Schizoneura ovipositing on dogwood (Cornus) and the one living on grass roots.

[4] Bull. 23, Iowa Experiment Station.

PSYCHOLOGY.

The Recidivist.—In the September *Forum* there appeared an article on the topic "Criminals not the victim of Heredity." On summing up, the writer comes to the conclusion that "a criminal is like any other man." It is the purpose of the present writer to show, by unimpeachable and incontrovertible evidence, that this last statement is a gross error. The *Forum* writer makes an indiscriminate use of the terms professional, habitual, and congenital criminal. A professional criminal is not, necessarily, a congenital criminal, nor is an habitual criminal necessarily a professional criminal. I presume that the writer of the article quoted above, means the recidivist all through his paper, and therefore will endeavor to prove that the congenital criminal and the recidivist is, anatomically and physiologically, entirely different from normal man in many respects. In this paper I do not wish to enter the domain of speculative psychology, nor do I intend to grapple with the grave problems now agitating sociologists and penologists, therefore will content myself with the introduction of facts and facts alone. The statement of the present writer that the recidivist is, anatomically and physiologically, an abnormal type of man, is not the conclusion of an hour or day, but is the rational deduction obtained from days, months, and years spent at the dissecting table and microscope, and in the study of the criminal, both in a state of freedom and when incarcerated. The criminal physiognomy is of so marked a type that most men are able to recognize it at a glance. I borrowed six photographs of criminals from Major Owen, Chief of Detectives, Louisville, Ky., for the purpose of illustrating an article on "Criminal Anthropology," (which article appeared in the *N. Y. Medical Record*, Jan. 13), selecting them at random from some fifty or sixty other photographs of criminals. Five of these photographs were recidivists, and one was an *occasional* criminal. These six photographs were shown to one hundred men with the following statement and request: "Here are six criminals; five of them are habitual malefactors, and one of them is, comparatively speaking, an honest man—pick out the honest man." Ninety-five men picked out the photograph of the *occasional* criminal without a second's hesitation. The discriminating and exact Maudsley says: "All persons who have made criminals their study, recognize a distinct criminal class of beings, who herd together in our large cities in a thieves quarter, giving themselves up

to intemperance, rioting in debauchery, without regard to marriage ties or the bars of consanguinity, and *propagating* a criminal population of degenerate beings. For it is furthermore a matter of observation that this criminal class constitutes a *degenerate or morbid variety of mankind*, marked by peculiar low physical and mental characteristics. * * * * * * * Their *family likeness* betrays them as fellows by the hand of nature marked, quoted, and signed to do a deed of shame."[1] For obvious reasons, I have taken the liberty of italicizing certain words in the above quotation. A celebrated criminal lawyer of New York once told the writer that he could tell a recidivist at a glance, and that he never made a mistake in his diagnosis of moral obliquity. Professor Enrico Ferri, an Italian anthropologist, tells us that on one occasion he examined several hundred soldiers, and found only one whose face declared him a criminal. He afterwards ascertained that this man had committed murder. Lombroso submitted to thirty-two young girls the photographs of twenty thieves and twenty moral men. Eighty per cent. of these girls recognized the first as malefactors, the second as moral, upright men.[2] Emile Gautier, who was, for a time, confined in Lyons prison says that "these criminals have a general family resemblance, which makes them a class apart."[3] A warden of an eastern penetentiary (Sing-Sing) told the writer that there were not only twins in every prison, but there were "twins, triplets, quadruplets, ay! even twelvelets" (sic). An interesting point in connection with the criminal physiognomy is that it is to a large extent independent of nationality. The German criminal is not unlike the Italian, nor is the French unlike the English criminal. M. Joly remarks, 'I should say that in M. A. Bertillon's' office I was shown nearly sixty photographs of Irish, English, and American thieves. It would have been difficult in many cases to discern the Anglo-Saxon rather than any other physiognomy.[4]

Now let us analyze the criminal type, feature by feature, and see what constitutes this universal and well-marked physiognomy. The observations of the writer when in pursuit of this analysis, were not confined to any particular class of criminals; he examined all classes. He soon discovered, however, that this distinctive type was to be found in the congenital recidivist alone. The occasional criminal and the criminal by calculation (the true professional criminal), were found to

[1]Maudsley. Responsibility in Mental Disease, p. 29.
[2]Lombroso: L'Uomo Delinquente.
[3]Havelock Ellis: The Criminal.
[4]Havelock Ellis: The Criminal, p. 82

be anatomically and physiologically normal. In the recidivist there is marked exaggeration of the cephalic indices. In a dolichocephalic recidivist the long head is very noticeable. The same exaggeration is found in brachycephalic recidivists. Oxycephalism (sugar-loaf head) is very frequently observed. In three hundred drawings taken from live and dead subjects by the writer, one hundred and ninety-eight are oxycephalic. Lauvergne says of this kind of head: "When it is complete, that is to say, when it presents a prominent base supporting an inclined pyramid, more or less truncated, this head announces the monstrous alliance of the most eminent faculty of man, genius, with the most pronounced impulses to rape, murder, and theft." The bilateral elevation of the sagittal suture (Benedikt's lines[5]) has been noticed in the three of the six hundred, who form the class from which these deductions are drawn. Professor Benedikt considers these sutural elevations of great importance in criminal anthropology and in his book *Kraniometrie und Kephalometrie* says "that, though rare, when present they are significant of great moral obliquity." There is, generally, marked enlargement in the orbital arches of recidivists, together with receding foreheads. In three hundred and fifty of the four hundred profile and quarter-face photographs of habitual criminals that I have examined, this enlargement of the orbital arches was plainly noticeable. In the two hundred drawings and photographs that form my collection, it is noticeable in one hundred and eighty-two. Tenchini and Lombroso, as well as Benedikt, have pointed out this abnormality in the orbital arches of criminals. In my collection of skulls there are four skulls of recidivists; all of these show this enlargement of the orbital arches. Prognathism is a marked characteristic in the physiognomy of the recidivist. The large, heavy lower jaw and protruding mouth strikes the observer at once. This feature is rarely absent in the congenital criminal. It is an abnormality eloquent in its atavistic suggestiveness.

The low receding forehead, the enlarged orbital arches, the prognathous jaws, and high cheek-bones of the congenital criminal are strikingly like those of our pithecoid ancestors.[6]

Just here it is proper to state, that, in an article on Effemination and Viraginity which appeared in the *N. Y. Medical Record*, September 16th, I have asserted that atavism only attacks individuals of a neurasthenic type; that the phenomenon of reversion is found only in psychopathic aberrants. This, in a measure, is true in all cases of

[5]Benedikt: Kraniometrie u. Kephalometrie.

[6]The writer: Criminal Anthropology, N. Y. Med. Record, Jan. 13.

reversion, but, in the article alluded to, I then had reference to psycho-sexual atavism alone. Sexual perversion and psychic hermaphroditism are prominent characteristics of the congenital criminal; I do not intend, however, to discuss them in this paper. I have examined, macroscopically and microscopically, twenty-three criminal brains. Twenty of these brains were those of recidivists, and abnormalities were found in all of them. In one of them, taken from a criminal executed for an attempt at rape and murder, there was confluency of the fissures. In several of them the frontal lobe presented four (apparent) convolutions; in all of them there was deficiency in weight. In others the gray matter was scanty and thin, and the convolutions superficical and few in number. Havelock Ellis says: "The important matter of the vascular supply of the brain in criminals has yet received little attention, but a variety of pathological features have been found in the cerebral substance and membrance—pigmentation, degenerating capillaries, etc."; he then adds in conclusion, "It must be added, as a point of considerable importance, that in very few cases have these pathological lesions *produced any traceable symptoms during life.*"[7] There are two kinds of abnormal ears found in the criminal type; large out-standing ears, like those of the chimpanzee and nshiego-mbouve, and ears, small, and closely applied to the skull, like those of the gorilla. I have found that the small ear is generally possessed by the sneak-thief and pick-pocket, while the large ear is possessed by the burglar with murderous tendencies. In all my experience I have never seen an habitual petty thief with a large ear, while all the murderers whom I have examined had large ears. A prison-keeper said to be on one occasion: "I can tell a thief from a murderer every time, by the size and shape of his ears." (sic). I have thirty-six sketches of pick-pockets. These drawings were made from life, and are drawn to scale, and in all of them the ear is small and, generally, misshapen. One sketch, made of a convict now in an Indiana prison, shows the strange abnormality of a forked helix. Féré and Segelas present a cut of an ear somewhat like the sketch just mentioned. There are other abnormalities in the ear of the recidivist, such as "a development of the Darwinian tubercle, absence of one of the branches of the fork, absence of the helix, effacement of the anti-helix, etc., etc."[8] Most of these abnormalities are, unquestionably, atavistic attempts, and especially is this true of the small gorilla-like ear and the large, projecting chimpanzee-like ear.

[7]Havelock Ellis: The Criminal, p. 63.
[8]Ibid, p. 68.

The criminal has a peculiar, feral stare, which once seen and noted can never be forgotten. A noted detective, (Bligh of Louisville, now dead) called it the "ape-eye."[9] "Look," said he to me on one occasion when we were discussing criminals, "Look at the next ape you see and you will know what I mean." (sic). The congenital criminal,[10] when looking at one seems to focus his sight on a point some distance beyond one's body. It is difficult to describe this look. Bligh's "ape-eye" comes nearer to it than anything else I can think of.

The special senses are generally very much exaggerated in the congenital criminal. The hearing of twenty-eight recidivists out of thirty tested with the watch, was found to be more acute than normal. Some of these criminals possessed the microscopic eyesight of birds, describing the appearance of minute objects correctly, the details of which, to be seen by me, rendered the use of a lens absolutely necessary; and I may add that my eyes are normal.

Others were far-sighted, some of them being able to read Snellen's type at double the normal distance. The sense of smell, that is for some odors, was decidedly more acute than normal. I washed my hands in water scented with a few drops of violet perfume; they were then washed in pure water and carefully dried. Three billiard balls were then held in the hands for a few moments and then deposited on a table with a half dozen others. Thirteen out of the twenty-eight recidivists under observation, picked out the balls which had been handled declaring that they could plainly distinguish the violet odor. * * * * * I once knew a recidivist in St. Louis who could tell his friends by their personal odors.[11] I had this man's skull in my cabinet for a number of years; it was eventually stolen from me, and is now, probably, in some museum of anatomy. It was strikingly like the skull of the Man of Spy,[12] and an extraordinary instance of atavism in every structural characteristic. I have now analyzed the physiognomy of the congenital criminal feature by feature. When I place each part in its proper place I construct a mosaic of a variety in the human race entirely different from normal man. I have shown

[9]The writer: Criminal Anthropology, N. Y. Medical Record, Jan. 13.

[10]I wish to call attention to the fact that I consider the congenital criminal to be the only true recidivist. I make this distinction in order to emphasize the great difference that exists between the professional, occasional criminal, and the true recidivist who is born a criminal. J. W., Jr.

[11]The reader is respectfully referred to the works of Spencer, Tylor, Reclus, Wolfe and others for kindred observations on the special senses of savages.

[12]Wright: Man in the Glacial Period, p. 277.

that these abnormalities are anatomically and physiologically irregular. The brain, the seat of the moral function is involved as well as bone, nerve and tissue. I have said nothing of color (pallor) of the hair, of cutaneous insensibility, of the form and shape of the extremities, and of numerous other abnomalities. I think that I have proven that the recidivist is *not* "like every other man." I promised in the beginning of this paper that I would not enter the domain of metaphysics. I have, in another article, fully discussed this branch of the subject. I cannot refrain, however, from noticing several of the *Forum* writer's statements. His whole paper is made up of assertions, the basis of which are founded on personal beliefs. It is the old story of religion against science; the old mistake of separating mind and brain matter, when, in a measure, the two are identical. I am not an Averroist, nor am I a believer in the doctrines of emanation and absorption. But I do believe, (and this belief can be proven to be correct), that wherever there are receptive ganglia, whether in organisms high or low in the scale of animal life, there this element of the brain, which the Greeks called Psyche, enters in. The *Forum* writer says that he does not believe that the moral function is an inherited one. Does he believe that man sprang into existence fully endowed with all the mental attributes we find in him at the present time? Does he deny the fact that mind has undergone evolution and development since the time of our pithecoid ancestors? Does he mean to maintain that the brain of an infant born to-day is no further developed than was that of one born twenty thousand years ago? Would he have us believe that the moral function is no further developed in us than it was in the ancient Britons, or than it is in the autocthon of Australia? That morals are, to a certain extent, dependent on education, I do not for one instant deny, but that they are wholly so, no one, who knows the negro and the results of a hundred years of moral education expended on him, will for one instant affirm. I take the American negro simply because he is a convenient example. Morals are the result of evolutionary development, of inherited experiences, as much so as any other inherited function. The laws of atavism, of reversion to ancestral types, and of inheritance apply to the mind as well as the body. We cannot place morals, a purely mental function, on a pedestal by themselves and write beneath them "Cave! Deus Sum." Says the *Forum* writer: "The moment that he understands that 'honesty is the best policy' the average professional criminal becomes honest." As I have said before, in the first part of this paper, the *Forum* writer does not discriminate when speaking of criminals. Now this state-

ment may be true in the case of the professional criminal i. e. the criminal by calculation, but it is not true in the case of the recidivist. The recidivist never recognizes the fact that honesty is the best policy, but continues to commit anti-social acts until the end of his life. His moral imbecility, the direct result of atavistic degeneration, is such that he does not consider his anti-social acts criminal in any sense of the word. Dugdale in his remarkable work "The Jukes" has clearly proven how great a factor heredity is in the production of criminals. The evidence in his book alone ought to be convincing to any unbiased mind, but when it is substantiated by the evidence of such men as Lombroso, Ottolenghi, Ellis, Marro and Segelas it becomes absolute authority.

JAS. WIER, JR., M. D.

MICROSCOPY.[1]

Marine Planarians.—In a paper now in press (Journ. Morph., Vol. IX, No. 2), Dr. Wheeler gives a few notes on methods he employed in the study of *Planocera inquilina*, a Polyclad found in the branchial chamber of Sycotypus.

The Biondi-Ehrlich stain proved to be very useful in making the rhabdites conspicuous.

Owing to the lack of pigment, the nervous system may be traced without difficulty, especially in young specimens. It agrees closely with Lang's description and figures of the nervous system of *Planocera Graffii*. Remarkably clear pictures of the beautiful plexus and its connection with the brain may be obtained by killing in hot corrosive sublimate, staining for 12 hours in Czokor's alum cochineal, and, after dehydrating, mounting in gum sandarac dissolved in absolute alcohol.

In a second paper, l. c., p. 178, devoted to a Triclad (*Syncœlidium pellucidum*) found in the gill-books of *Limulus*, the method of studying the nervous system is described thus:

The great transparency of *Syncœlidium* makes it a very favorable object for the study of the nervous system. The brain and main nerve trunks may be readily seen in the living animal, but this method is insufficient for a study of details. It is, however, only necessary to stain with alum cochineal, extract as much of the stain as possible with water, dehydrate and mount directly from absolute alcohol in gum sandarac to obtain a diagrammatically clear picture of all but the very finest details of the nervous system. The nerves stand out as white lines on a darker background.

Breeding Habits of the Three Triclads of Limulus.—*B. candida*, *B. propinqua* and *S. pellucidum* all deposit their egg-capsules on the gill-lamellæ of their host, *Limulus*. The first species seems to show no preference for a particular region of the gill-leaf, but scatters its egg-capsules over the whole surface. *B. propinqua* selects the basal, or proximal region of the leaf, while *Syncœlidium* prefers a small area near the edge and just lateral to a small marginal callosity which forms a brown line with the callosities of the adjacent leaves when the gill-book is closed.

The egg-capsule of *Syncœlidium* is about .75 mm. long, of an oblong shape and somewhat compressed. It is attached by a slender pedicel, .5 mm. in length, in such a way that one of the flattened sides of the capsule is applied to the surface of the gill-leaf. Usually the capsules

[1]Ed. by C. O. Whitman, Univ. of Chicago.

are arranged with their long axes parallel to one another in a little cluster near the marginal callosity. The chitinous wall of the capsule is thin and transparent, but grows thicker towards the poles. Through it the two opaque white eggs or larvæ may be distinctly seen. I have never found more than two eggs in a capsule.

Many of the capsules bear at their outer ends one or more of the deep blue thecæ of an infusorium. These were regarded by Gissler as pneumatic tubes, but Ryder showed that they were the thecæ of "Protozoa of the genus *Epistylis* or *Zoothamnion*."

Both Ryder and Gissler figure the egg-capsules of *Syncœlidium* After describing the capsules of *Bdelloura*, Ryder says: "The second form, represented in Figs. 5–7, enlarged 16 times, is much smaller, but similar in structural features to the preceding. The capsules measure about $\frac{1}{25}$ of an inch in length and contain usually 2 eggs or embryos. At first the ova occupy each one of the ends of the capsule, as shown in Fig. 5; but after the young worms have developed somewhat, they usually lie alongside of each other lengthwise of the capsule. They frequently change positions, however, at this stage and it sometimes happens that there is but one embryo in a capsule."

Gissler's Fig. 2^b is evidently the capsule of *Syncœlidium*, as shown by its size relatively to the infusorial thecæ attached to its summit.

For a description of the egg-capsule of *B. candida* I would refer the reader to the papers of Leidy ('51), v. Graff ('79), Ryder ('82a) and Gissler ('82).

What I take to be the egg-capsule of *B. propinqua*, is considerably smaller than that of the allied *B. candida*, measuring only 1.25 mm. It appears to contain only one ovum, instead of 2–7 as in *B. candida*, but on this point I cannot be positive. I am unable to identify this form of capsule with any of those described by Ryder ('82a).

The three *Limulus*-infesting Triclads differ also in their time of breeding. *B. candida* oviposits during May and early June, when the *Limuli* return from the deep water to the sandy beaches to breed. The passage of the Triclads from one crab to another must be favored by the prolonged coitus of the latter. *Syncœlidium* oviposits in the latter part of July and the early part of August, when the gills are deserted by the half-grown young of *B. candida* for the basal joints of the cephalothoracic appendages. As the *Limuli* have laid their eggs and begin to return to deep water by the first days of July, it is necessary, in order to study *Syncœlidium* and its habits, to collect a number of the crabs early in the season and to confine them in a large fish-box or similar receptacle. *B. propinqua* appears to breed at the same time as *Syncœlidium*.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

New York Academy of Sciences.—Biological Section.—April 9. H. F. Osborn, in "A division of the Eutherian Mammals into the Mesoplocentalia and Cenoplacentalia", noted that the radiation of the mesozoic placentals into carnivorous, herbivorous and insectivorous types, was analogous to that of recent placentals, or to that of Australian marsupials; Mesoplacentalia would represent a group primitive, as in foot and brain, of great evolutional inertia; it would include Amblypoda and Condylarthra as ungulate types, the Creodonta, Tillodonta and Insectivora as Unginculates and the Lemuroidea as primates.

O. S. Strong, exhibited "Nerve-cell Structures as demonstrated by Golgimethods", and presented for publication a memoir on the "Origin and Peripheral Distribution of the Cranial nerves of Amphibians."

P. Gibier, "A note on Glycosuria produced Experimentally."

A. B. Matthews, "On the Structure and Physiology of the Pancreas Cell." Bashford Dean, *Recording Secretary.*

Proceedings of the Natural Science Association of Staten Island.—April 14th, 1894 Mr. Chas. W. Leng exhibited living and mounted specimens of beetles, new to or rare on the Island, with the following memoranda:

Bryaxis abdominalis (aube).

Three years ago I found a number of small beetles clinging to the underside of pieces of bark and wood lying on the banks of a salt meadow creek near Arlington; the beetles were first observed by me at the point where the railroad embankment ends and the trestle begins, but Mr. Davis had previously found the same or a closely allied species at other points on the border of the salt meadow. These beetles proved to be *Bryaxis abdominalis*, one of the Pselaphidæ, an addition to the fauna of Staten Island, and, in view of the numbers in which they were found and the rarity of the species of this family as a rule, an addition of unusual interest.

During the early spring of 1893 and again this year I have made some careful observations to determine the date of appearance and the exact localities frequently by those beetles. They may be found early

in February and as late as May, but disappear entirely in the summer months. During this brief period the eggs that are to produce the succeeding generation are laid and their life work being ended the beetles die.

To determine the localities I examined the border of the salt meadow at various points, usually accompanied by Mr. Davis. South of Oakwood a narrow peninsula of upland juts out into the meadow and there, on March 18th, the beetles were plentiful; the slight rise of ground was littered with boards, logs and fragments of bark, carried far inland by unusual tides, and almost every piece sheltered a *Bryaxis*. They did not extend more than ten feet from the meadow and they avoided those boards which were within a few feet of the meadow and constantly damp. On March 25th we searched the border of the meadow west of Richmond. The tides reach these meadows only by way of the Fresh Kills and the wreckage is sparse, perhaps becoming stranded before it reached so far inland. No *Bryaxis* were found. On April 1st I visited the strip of sandy upland that stretches into the meadow south of the water company's wells at New Springville. The conditions existing near Oakwood are here repeated and *Bryaxis* was found in some numbers. On the same day I crossed the turnpike and visited the meadows east of Chelsea, but there is an absence of any sharp dividing line between meadow and upland at that point; no suitable shelter is formed and no *Bryaxis* were found. On April 8th Mr. Davis, Mr. Walter Granger and I examined the meadows at Watchogue very thoroughly but found no large number of beetles. The day was, however, unfavorable and may have affected the result. During this period Mr. Davis twice visited the original locality at the trestle and found the beetles in numbers. This locality is particularly favorable; the operations of the railroad company have caused a quantity of soil to be thrown up in hillocks and ridges which afford the necessary retreat from high water and at the same time a lodging place for the chips and bark that shelter the beetles.

As the result of these observations, repeated in different years and at widely separated localities, I think I am justified in stating that *Bryaxis abdominalis* is abundant from February to May at the border of the salt meadow all around Staten Island; living not on the meadow or near enough to feel the influence of its dampness, but under wood or bark cast by the tide upon the upland.

These beetles are quite small and Mr. Craig kindly prepared a specimen for exhibition under the microscope.

The form of the antennæ, the single tarsal claw and the sculptured abdomen of the male are the characters specially noteworthy.

The family to which this beetle belongs comprises a goodly number of minute beetles, found either beneath stones or wood or in ants' nests. Their habits are but little known; they live on animal substances and their powerful mandibles and long palpal members seem to indicate that they capture fleet and hard shelled prey; some live in pairs while others are gregarious; those living in ants' nests appear to be true inquilines; the ants which support them, by caressing the tufts of hair about the abdomen, cause the exudation of a fluid which they greedily swallow. The larvæ are unknown.

An excellent monograph, by Brendel and Wickham, may be found in the Bull. Laborat. Nat. Hist., State Univ., Iowa, Vol. 1 and 2.

It may be noted that two other minute beetles are always found with this *Bryaxis*, viz: *Scydmænus salinator*, Lec. and *Rhypobius marinus*, Lec. They are not confined to such narrow limits as the *Bryaxis* but invariably occur where it occurs.

Mr. Leng also contributed the following: *Notes on Naias Flexilis.*

The water plant, *Naias flexilis* (Willd.), Rost. and Schmidt, reported by Mr. Davis at our last meeting, occurs also at Springville and at Bull's Head.

At Springville sparingly, in a small pool on the edge of the meadow, south of Union avenue in the second large field west of the Morning Star road.

At Bull's Head abundantly, in a ditch running south from Lambert's Lane and about a quarter of a mile west of the Morning Star road.

Mr. Arthur Hollick presented a set of three barred owl's (*Syrnium nebulosum*) eggs and read the following memorandum:

In our Proceedings for April 11th, 1891, may be found a short note in regard to a barred owl's nest having been found by Mr. Chas. Rufus Harte, in the vicinity of Bull's Head, on March 27th of that year. On March 12th, 1892, it was again visited by Mr. Harte, as noted in the Proceedings for April 9th, 1892. On each occasion he obtained a set of three eggs from the nest. So far as I am aware the owls were not disturbed in 1893.

I had obtained a rough diagram of the vicinity, sketched by Mr. Harte, and on March 11th, of this year, I undertook to search for the nest. With comparatively little trouble I located the tree, which is situated in the patch of woodland between Bull's Head and Willow Brook. The cavity in which the nest is located faces northwest and is about thirty feet from the ground. The tree is about five feet in

diameter, and destitute of branches below the cavity, so that I found it impossible to climb up. On March 17th I obtained a pair of climbing irons, and with these readily ascended to the nest, which I found to contain the usual number of three eggs, slightly incubated.

The tree is not one which would be likely to attract attention, as it is a vigorous living red oak (not a sweet gum as originally stated), and the cavity is not conspicuous. The female bird was readily alarmed—a slight tap on the tree being sufficient to cause her to leave the nest and to retire to some distance. I did not see the male bird at any time.

In this patch of woods gray squirrels are yet comparatively abundant and one or more pairs of red shouldered hawks nest there every year, besides many crows, but it is doubtful if they can remain undisturbed much longer, as the timber is large and valuable and in several sections the finest trees have been thinned out quite recently.

Mr. Wm. T. Davis exhibited a living pupa and mud cone of the seventeen year locust, with the following memorandum:

The pupæ of the seventeen year *Cicada* have made their appearance. While searching for *Bryaxis*, with Messrs. Leng and Granger, on April 8th, I found several under boards on the edge of the meadow at Old Place creek, one of which I am able to exhibit alive. The ground being damp the pupæ had erected their usual towers of earth, the boards not lying sufficiently close to the uneven ground to prevent their construction.

In the Proceedings for February 10th, 1894, the *Cicadas* that appeared in 1881 should have been referred to Brood XVII instead of XVIII.

Boston Society of Natural History, April 18.—The following papers were read. Mr. Herbert Lyon Jones: Adaptations of fruits and seeds for the purpose of distribution. Dr. Benjamin Lincoln Robinson: Observations upon tropical climbers. Samuel Henshaw, *Secretary.*

SCIENTIFIC NEWS.

The University of Illinois is to open a permanent station on the Illinois River for the biological study of the flora and fauna of the waters of the state. Havana has been selected as the location and suitable laboratory quarters have been obtained. Work will be begun in April and the station will be kept open throughout the year. The Illinois State Laboratory of Natural History and the State Fish Commission will co-operate and the whole will be under the direction of Professor S. A. Forbes. Professor Forbes has selected in the vicinity of Havana a set of typical situations which will be explored throughout the year and probably for several years in succession. The main object is the thorough investigation of the entire system of the plant and animal life of the waters of that region with principal reference to problems of œcology; above all to the effect of the periodical overflow and recession of the waters upon the variety, abundance and interaction generally of the various groups of plants and animals represented in those waters.

Some students may have the Leitz's Mechanical Stage. The following directions copied from the American Edition of Leitz's catalogue of Microscopes and Accessories published by Richards & Co. of New York *may* enable them to apply the apparatus to their stands. "The screw on the right must be lost so, that the lever, of the form of an arc of a bow, can turn around the axis at which it is fixed on the left. Afterward, the stage is to be put on the stage of the mieroscope so, that both angle pieces, opposite to the lever, drives the column of the stand; after putting the lever to its place, the screw gets fastened again. At last, the stage, must be fixed to the column, by drawing close the other screw, being in the middle part of the lever."

Dr. Edmund Beecher Wilson has been elected Professor of Zoology in Columbia College. He was previously adjunct professor of biology.

Dr. L. Will, well-known for his studies in Hexapod morphology, has been called to the chair of Zoology in the University of Rostock.

Dr. F. Ulrich, Professor of Mineralogy and Geology in the technical school at Hannover, died Jan. 25, 1894.

Dr. C. V. Riley has tendered his resignation as U. S. Entomologist, to take effect June 1, 1894. After that date his address will be U. S. National Museum, Washington, D. C.

Dr. Alexander Theodor von Middendorff, possibly best known for his Siberian expedition, died at Hellmorm, Livonia January 28, 1894 aged 79 years.

Dr. Credner, who had been announced as the successor of Prof. H. B. Geinitz in the chair of Geology in the Dresden Technical school, will remain in Leipzig. The place will be filled by Prof. E. Kalkowsky of Jena.

The botanist O. L. Sillén of Gefle, Sweden, is dead.

Dr. Leopold von Schrenck, well-known for his explorations of the Amur basin, died in St. Petersburg, Jan. 20, 1894.

Dr. G. Linck, formerly docent, has been made Professor of Geology and Mineralogy in the University of Strassburg.

Dr. George Gordon, well-known to older naturalists. died in Edinborough, Dec. 12, 1893, aged 92 years.

Prof. Edward Zacharias of Strassburg has been called to Hamburg as director of the Botanical Gardens.

Dr. A. Knop., Professor of Mineralogy In the technical school at Karlsruhe, died Dec. 27, 1893. Dr. R. Brauns of Marburg has been appointed extraordinarius in his place.

Richard Spruce, the student of South American Mosses, died at Malton, England, Dec. 30, 1893.

Dr. W. Migula has been called as Professor of Botany and Bacteriology to the technical school of Carlsruhe.

The trustees of the "Elizabeth Thompson Science Fund" have issued their circular for 1894 announcing that the income from the fund, now amounting to $26,000 will be available for distribution in June next. Already nearly $9000 have been distributed in past years to 46 applicants, and in 22 cases the results of work advanced by the fund have been published. This endowment is not for the benefit of any one department of science, but it is the intention of the trustees to give the preference to those investigations which cannot otherwise be provided for, which have for their object the advancement of human knowledge or the benefit of mankind in general, rather than to researches directed to the solution of questions of merely local importance." The Secretary

of the trustees is Dr. C. S. Minot, Harvard Medical School, Boston, Mass.

Dr. Carl Grobben has been raised to the ordinary professorship of Zoology in the University of Vienna.

Dr. George Bennett, an Australian explorer and Naturalist, died at Sydney in October, 1893, aged 90 years.

Mr. August Carl Eduard Baldamus, the ornithologist, died in Wolfenbüttel, Oct. 31, 1893, aged 82.

Juan Vilanova y Piera, Professor of Geology in Madrid, died in the beginning of November.

C. von Gumpenberg, a student of the Lepidoptera, died in Bamburg, Germany, Nov. 5, 1893.

A. Halfar, Geologist of the Prussian Geological Survey, died in Berlin, Nov. 21, 1893.

Prof. Joseph Boehm, the well-known plant-physiologist, died in Vienna, December 2, 1893.

Dr. Tomquist has been made private docent in Geology and Palæontology in the University of Vienna.

Professor Arcangeli Scacchi, the student of Vesuvius, died in Napha, Oct. 11, 1893.

Dr. J. M. Undset, the investigator of prehistoric Scandinavia, died in Christiania, Dec. 3, 1893, aged 40 years.

George Primics, geologist, died in Belénges, Hungary, Nov., 1893.

H. J. Rink, whose work on Greenland is the handbook upon all Arctic questions, died in Christiania, Dec. 15, 1893.

Dr. Luigi Luciani has been called to the chair of Physiology at the University of Rome as successor to Moleschott.

Prof. W. Krause of Göttingen has been given charge of the collections of the I. Anatomical Institute at Berlin.

Prof. R. Altmann of Leipzig, has been called to the chair of Anatomy in Halle.

Dr. A. Heider, the Bacterologist, died in Vienna, Dec. 26, 1893.

Professor August Wrzesniowski, well-known for his Protozoan studies, died in Warsaw, December last.

The Wollaston medal of the Geological Society of London, has been given to Prof. K. A. Zittel, the Palæontologist of Munich.

The Proposed Division of the National Academy of Sciences.—The following letter explains itself. To the Committee appointed by the U. S. National Academy of Sciences, April, 1892, "to report such proposed modifications of the Constitution and By-Laws of the Academy as are likely in their judgment to increase its efficiency" etc., of which Prof. T. C. Mendenhall is chairman;

Gentlemen: I take the liberty of making some suggestions with reference to the classification of the Academy into divisions, which will in the writer's estimation "increase its efficiency" etc. This increase of efficiency is, in the writer's view, chiefly to be accomplished at present, by electing to membership persons competent in their professions, in such proportionate numbers as to represent properly those professions, as at present cultivated in the United States. At present the disproportion of membership in favor of some departments, and to the prejudice of other departments is great, as the following figures show. Of members which represent the physical sciences, we have now, according to the figures presented at the late meeting, (April, 1894), by your committee, 58; while but 31 represent the Natural Sciences. If the members which represent the proposed section F be added to the division of Natural Sciences, (which they should not be in a correct classification) the latter will include 39 members as compared with 58.

The Academy adopted, at its late meeting of April, 1894, two classes, I and II, those of the Physical and Natural Sciences. The former includes the proposed sections A, B, and C, of the committees original plan; and the latter the proposed classes D, E, and F, of that plan. This primary division appears to me to be more convenient in practice than a closer subdivision, for the reason that a nearly equal division of membership between those two classes accords more nearly with the relative numbers of cultivators of those sciences in this country and in the world generally, than any other divisions that can be proposed. As a matter of fact the cultivators of the Natural Sciences are more numerous than those of the Physical Sciences, as the relative extent of the literature of the two divisions indicates. I do not suggest that this preponderance of the Natural Sciences shall be represented in the National Academy, but that there shall be an equality of representation of the two. In a closer subdivision the relative numbers of members of each division is more likely to be variable, or for various reasons more difficult to ascertain, and thus more likely to cause dissatisfaction from time to time.

The division into the two classes of the Physical and Natural Sciences does not, however, embrace all the sciences, and is hence defective. It does not take into account applied science, which it is necessary that we recognize, owing to our connection with the government. While we necessarily embrace members competent in this great field, we cannot open our doors to a large representation of it, since pure science is our principal aim. As most human industries are more or less perfectly applied science, we must necessarily strictly limit our membership in this direction.

The sciences which you have proposed to include in the class F, are Statistics, Hygiene, Philology and perhaps others. To these might be added the science of mind objectively studied, or Psychology, and also that of human industries treated historically and descriptively. This entire group (excepting Hygiene, which is applied science), differs from those of the Natural and Physical Sciences in that its subjects are penetrated and affected by the interference of the human mind.

I would therefore, propose the following division of the Academy's membership into four classes, two of which have been already adopted.

Class I.—Physical Science; (Sciences of energy); to include Physics, Astronomy, Chemistry, Physiology, and Dynamical and Chemical Geology.

Class II.—Natural Science; (Sciences of Morphology); Structural Geology, Mineralogy (apart from Chemistry) Biology (including Embryology and Paleontology).

Class III.—Anthropological Science (Sciences treating of phenomena determined by psychic conditions); Anthropology, Statistics, Philology, Psychology.

Class IV.—Applied Science. (Applications in the Arts of any of the Sciences previously enumerated); including Hygiene, Engineering, etc.

It will be observed that in the above classification geology is divided. This is inevitable, as the science is a composite one. Members might in this case choose whether they would prefer as geologists to be referred to Class I or Class II.

I would suggest that the members of each class be fixed as follows:

Class I, 35 members; Class II, 35 members; Class III, 15 members Class IV, 15 members; total 100 members.

It seems to me that both comprehensiveness and simplicity may be claimed for the above proposition.

Very respectfully,

Philadelphia, April 21st, 1894. E. D. Cope.